S. HRG. 100-833

PROPOSED FISCAL YEAR 1989 BUDGET REQUEST (DOE's Fossil Energy R&D and Clean Coal Technology Programs)

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY RESEARCH AND DEVELOPMENT

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

SECOND SESSION

ON THE

DEPARTMENT OF ENERGY'S FISCAL YEAR 1989 BUDGET REQUEST FOR FOSSIL ENERGY R&D AND CLEAN COAL TECHNOLOGY PROGRAMS

APRIL 28, 1988

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PROPOSED FISCAL YEAR 1989 BUDGET REQUEST

(DOE'S FOSSIL ENERGY R&D AND CLEAN COAL TECHNOLOGY PROGRAMS)

THURSDAY, APRIL 28, 1988

U.S. SENATE,
SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The subcommittee met, pursuant to notice, at 1:28 p.m., in room SD-366, Dirksen Senate Office Building, Hon. Wendell H. Ford, presiding.

OPENING STATEMENT OF HON. WENDELL H. FORD, U.S. SENATOR FROM KENTUCKY

Senator FORD. Good afternoon, ladies and gentlemen.

Energy security, environmental improvement, world trade and U.S. jobs are essential to the economic future of our Nation. We must work toward a brighter energy future that includes preserving or improving U.S. competitiveness, preserving or improving U.S. advances in technology development and keeping U.S. jobs in the United States.

It isn't too long ago, in the 1970's, that we were far too dependent on foreign oil. This country worked hard to achieve a 50 percent decline in imports between 1977 and 1985. We must not forget those efforts. We must not return to a situation of complacency. Complacency will, in turn, lead to increased U.S. imports, to a decline in the balance of trade, and ultimately to a loss of U.S. jobs.

The dangers of increasing our dependence on foreign oil are obvious. This is especially true with the situation in the Persian Gulf being what it is.

We can and must minimize this danger by expanding the slate of technologies that use domestic energy resources. Federal R&D efforts are essential to expanding our knowledge in this area. We can't fall back into a situation like we were in during the 1970's. I believe that the administration would agree with me on this. For example, DOE's March 1987 Energy Security Study emphasizes that we must "recognize the warning signs and take thoughtful and prudent action that meets our responsibility to consumers, industry and the nation alike."

Why then does DOE propose to make a 50 percent cut in the level of funding for its fossil energy programs? What about the warning signs? We have lost approximately 56,000 coal-mining jobs since 1980. In addition, petroleum imports represent approximately

25 percent of the U.S. trade deficit, and the percentage is growing. That is roughly $45 billion of our trade deficit. There are also the recent events in the Persian Gulf. Aren't these warning signs enough?

On a more supportive note, I am very pleased with DOE's progress in the "Innovative Clean Coal Technology Program." I understand that a request for proposals for projects focusing on retrofit and repowering of existing facilities has been sent out, and that DOE is expecting a strong response. I certainly hope so because I look forward to seeing some of those ideas put into practice hopefully in the very near future. I urge DOE to try to maximize the $536 million they have in order to develop technologies in all regions of the country and that use all types of coal.

Clean coal technologies are the most promising technologies for helping deal with the environmental consequences of burning coal. Other technologies, such as wet scrubbers, are very costly and affect the efficiency of the powerplant to which they are attached. Also, scrubbers do a very good job of removing sulfur dioxide from the coal, but they don't do nearly as good a job in removing the other pollutants, such as nitrogen oxides. A strong Federal effort to develop clean coal technologies is essential to our environmental and our economic future.

As a cosponsor of S. 879, the clean coal legislation pending before this committee, I am convinced that it or something like it contains critical elements of any sound approach to the development of clean coal technologies. The legislation would allow the development of emerging technologies, going well beyond the Canadian concerns that we have been hearing a lot about here lately that first led the administration into the clean coal arena.

This legislation would also lead to some constructive changes in State level utility regulations which tend to favor established technologies, even when they lead to high fuel costs and inefficient operations. To correct this situation, rate-making authorities must be encouraged to give full consideration to the needs of utilities seeking to use the cleaner and more efficient technologies of the future.

I am interested in learning more about DOE's and FERC's actions stemming from the recommendations of the Vice President's Task Force on Regulatory Relief that are intended to reduce risk and lessen the regulatory barriers to the future development and deployment of clean coal technologies.

Secretary Wampler, I welcome you here today to talk with us about the Department of Energy's fiscal year 1989 budget for fossil energy. I am also looking forward to discussing the status of the clean coal programs with you.

I have a statement from the Chairman of the full committee, Senator Johnston, and I ask that it be included in the record at this point.

[The prepared statement of Senator Johnston follows:]

STATEMENT OF SENATOR J. BENNETT JOHNSTON

HEARING ON FY 1989 FOSSIL ENERGY BUDGET

SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT

APRIL 28, 1988

I CONGRATULATE SEN. FORD FOR HOLDING THIS HEARING TO REVIEW THE DEPARTMENT OF ENERGY'S FISCAL YEAR 1989 BUDGET REQUEST FOR FOSSIL ENERGY RESEARCH AND DEVELOPMENT AND FOR THE CLEAN COAL TECHNOLOGY PROGRAM.

THE IMPORTANCE OF COAL AS A DOMESTIC ENERGY RESOURCE SHOULD NOT BE UNDERESTIMATED. UNFORTUNATELY, COAL-DERIVED ENERGY IS SADLY NEGLECTED BY THIS ADMINISTRATION.

COAL IS IMPORTANT TO OUR CURRENT ENERGY MIX. IN 1986, 17.3 OF THE 77.0 QUADS (ABOUT 22%) OF THE ENERGY CONSUMED IN THE UNITED STATES CAME FROM COAL. AS ENERGY CONSUMPTION INCREASES, AS IT WILL, EVEN WITH A STRONG EFFORT IN ENERGY CONSERVATION, COAL USE WILL ALSO INCREASE - TO OVER 25% OF OUR ENERGY CONSUMPTION AFTER THE TURN OF THE CENTURY.

IN THE ELECTRIC UTILITY SECTOR, COAL IS OUR PRINCIPAL FUEL, ACCOUNTING FOR 54% OF THE ENERGY CONSUMED. THIS PERCENTAGE WILL

HOLD OR EVEN INCREASE AFTER THE TURN OF THE CENTURY, DEPENDING ON WHAT HAPPENS WITH THE NUCLEAR POWER OPTION.

SO WE ARE GOING TO USE A LOT OF COAL, NO MATTER WHAT HAPPENS, AND WE WOULD LIKE TO USE EVEN MORE. FROM THIS PERSPECTIVE, IT JUST MAKES NO SENSE TO ME FOR THE ADMINISTRATION TO BE CONTINUING THIS TIRESOME RITUAL UNDER WHICH THE PRESIDENT'S BUDGET REQUEST SAVAGES FOSSIL ENERGY PROGRAMS, AND CONGRESS IS FORCED TO RESTORE THE NEEDED FUNDING. THEN THE PRESIDENT MAKES HIS NOW PATENTED CONGRESS-BASHING SPEECH ABOUT EXCESSIVE SPENDING.

THIS RITUAL DOES NOT SERVE THE PUBLIC POLICY PROCESS. THE ADMINISTRATION KNOWS A STRONG COAL RESEARCH PROGRAM IS NEEDED. WE KNOW IT IS NEEDED. YET WE GO THROUGH THIS SAME GAME, YEAR AFTER YEAR.

THIS YEAR IS NO DIFFERENT. FOR FY 1989, THE ADMINISTRATION'S REQUEST WOULD CUT THE FOSSIL ENERGY BUDGET BY 49% RELATIVE TO THE FY 1988 APPROPRIATION.

THE COAL RESEARCH PART OF THAT BUDGET WOULD BE CUT BY 58 PERCENT. THE COAL LIQUEFACTION PART OF THE COAL RESEARCH BUDGET WOULD BE CUT BY 62 PERCENT. MHD WOULD GET ABSOLUTELY NOTHING - A CUT OF 100 PERCENT. UNDERGROUND COAL GASIFICATION WOULD BE CUT BY 89 PERCENT.

THE RESEARCH PROGRAMS IN OTHER FOSSIL FUELS RECEIVE SIMILAR TREATMENT IN THE PRESIDENT'S REQUEST.

OIL SHALE RESEARCH WOULD BE CUT BY 90%, AND UNCONVENTIONAL GAS RECOVERY RESEARCH WOULD BE CUT BY 83 PERCENT. THE ONLY INCREASE IN THE FOSSIL BUDGET INVOLVES ENHANCED OIL RECOVERY.

I WOULD ONLY SAY THAT THIS YEAR OUR RESPONSE IN CONGRESS WILL BE THE SAME. WE WILL HAVE TO ADD THE MONEY. BUT WE CAN'T RUN THESE PROGRAMS EFFECTIVELY WITH ONLY THE CONGRESS ON BOARD. WE OUGHT TO BE PRODUCING A COMMON SET OF GOALS FROM THE INTERACTION OF THE EXECUTIVE AND CONGRESS. THE ADMINISTRATION ONLY DAMAGES ITS CREDIBILITY - AND THAT OF SOME VERY DEDICATED PUBLIC SERVANTS IN THE DOE WHO TRY TO MAKE THE PROGRAMS WORK - BY THESE TOTALLY UNREALISTIC BUDGET REQUESTS.

THE PRESIDENT AND SOME OF HIS ADVISORS LIKE TO COMPLAIN ABOUT CONGRESSIONAL MANAGEMENT OF EXECUTIVE BRANCH PROGRAMS. THAT IS JUST WHAT THIS KIND OF BUDGET REQUEST INVITES.

WE OUGHT TO DO BETTER. I'M SORRY WE WILL HAVE TO WAIT FOR A NEW ADMINISTRATION TO BEGIN A COOPERATIVE PROCESS.

Senator FORD. Secretary Wampler, we are delighted to see you. I apologize for my long statement, but I wanted to get that in the record. Since I have nothing else this afternoon but debate the problem of AIDS and whether you give clean or dirty needles, I decided to come over here and discuss fossil fuel and clean coal technologies with you.

STATEMENT OF HON. J. ALLEN WAMPLER, ASSISTANT SECRETARY, FOSSIL ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY DONALD BAUER, PRINCIPAL DEPUTY ASSISTANT SECRETARY; AND JEREMIAH WALSH, DEPUTY ASSISTANT SECRETARY FOR MANAGEMENT

Mr. WAMPLER. Thank you, Mr. Chairman.

It is again a pleasure to appear before this subcommittee. I have with me at the table, to my right, Mr. Donald Bauer, my Principal Deputy, and to my left, Mr. Jerry Walsh, who is the Deputy Assistant Secretary for Management. There are other key members of staff present here, and with the subcommittee's permission, I may ask them to assist me in some of your more detailed questions.

I also appreciate the subcommittee's consideration by including my formal statement in the record and permitting me to summarize its key points.

The budget we have submitted to you is one that we believe is necessarily aggressive in those areas where a more near-term emphasis is warranted, such as in the demonstration of clean coal technologies as the centerpiece of the Administration's response to concerns over acid rain, and in the area of enhanced oil recovery where we have undertaken several new initiatives and have proposed a fiscal year 1989 level that is significantly higher than our previous requests.

Our proposed budget is also technically sound. It emphasizes those areas where we continue to build a solid base of scientific and technical expertise, in areas such as coal, oil and gas-related research and development.

And equally important, Mr. Chairman, it is an affordable budget. The items contained in our request have been balanced against a host of pressing, and often competing, priorities. Admittedly, there is a wealth of project ideas and concepts that could be legitimate and worthwhile candidates for Federal funding.

We have subjected those ideas and concepts to a very rigorous screening process, and those that have emerged, and which are contained in this budget proposal, represent those that we believe are of the highest priority to the continued advance of fossil fuel technology. They are the programs and projects we believe will help move the technology of coal, oil and gas into the 21st century.

As I have outlined in our formal statement, our budget is made up of two major components, the Clean Coal Technology Initiative and the Fossil Energy Research and Development Program. The two are complementary but have distinctly different orientations.

As the subcommittee is aware, the Clean Coal Program provides Federal matching funds to demonstrate the commercial viability of a new generation of environmentally improved, high efficiency coal technologies. This program will produce a new suite of coal com-

bustion and pollution control facilities that will be unmatched by any nation in the world, each project providing the performance data and the operational experience necessary for the private sector to make future deployment decisions.

The Clean Coal Program is now well underway, and it is an effort in which both the Congress and the Administration can take justifiable pride.

The President's initiative incorporates a portion of, and builds on, the ongoing $400 million effort approved by Congress in fiscal year 1986. The budget for this program in fiscal years 1988 and 1989 is $575 million, and it is the amount that reflects last year's congressional approval of the first increment of the President's $2.5 billion 5-year initiative.

As the chart on page 1 of my formal statement shows, $536 million of these funds have been made available for project financing. On February 22, the Department issued its second solicitation for clean coal technology projects. Proposals are due on May 23 and we expect to select projects by late summer.

A second aspect of our Clean Coal budget proposal is our request for advanced appropriations for the remaining $1.78 billion to complete the President's initiative.

We remain committed to the full scope of the Clean Coal Technology Program and, consequently, we are requesting that Congress restore full funding for the Program by appropriating in advance $575 million for fiscal year 1990, $600 million for fiscal year 1991, and $600 million for fiscal year 1992. Advanced appropriations are important for two principal reasons.

One, it is important for the United States to demonstrate its commitment to the full implementation of the Special Envoy's Report on Acid Rain. This is necessary both in our international relations and in assuring domestic firms that the government is prepared to stand behind its commitment to cost-sharing.

Second, it is important from an R&D perspective. Several promising clean coal concepts are now in the R&D pipeline. Many are not sufficiently mature to compete for clean coal funds today, but they could be considered as candidates within the next two to three years.

For their development to continue today with as much private financing as possible, sponsors need to have the confidence that the Federal commitment and the necessary cost-sharing funds will be available to take the final step at the end of their development phase. Funding for the Clean Coal Technology Program, therefore, serves as a stimulus for continued private research and development today.

The Clean Coal Technology Program is certainly one of our most visible parts of the Fossil Energy Program, but it should not overshadow the second component of the budget, the core R&D effort.

The $168 million we are proposing for coal, oil and natural gas research and development is a 53 percent reduction from the amount appropriated in fiscal year 1988. In many ways, Mr. Chairman, the number is misleading. Fully half of the proposed reduction can be attributed to the phaseout of four projects that have achieved their objectives—these are the Wilsonville and LaPorte liquefaction projects, the Waltz Mill gasifier facility, and the phos-

phoric acid fuel cell program—and our recommendation to cease funding for the MHD program.

It is also important to look at our fiscal year 1989 request, in context, with our request of last year. By this comparison, our budget would increase by $17 million. Six of the nine major categories in the coal program would increase in funding.

The Enhanced Oil Recovery Program would increase by more than 75 percent, and we have substantially boosted our request for geosciences research.

In other words, Mr. Chairman, we have arrived at a budget recommendation that we feel strengthens those areas that needed strengthening and deemphasizes those areas where goals have been achieved and targets met.

We have also pursued a policy, in the last year, of leveraging Federal funds to the greatest extent possible. Here, Mr. Chairman, we can point to the positive benefits of cooperative efforts we have begun with several States. We have eight such cooperative efforts underway with Alaska, Kentucky, Illinois, Indiana, Alabama, Texas, Wyoming and Oklahoma. And we hope to expand that list in the near future.

The Kentucky effort, for example, uses matching funds from the Federal Government and the Commonwealth for two specific projects, one involving a study of the obstacles to the industrial use of fluidized bed technology and the other dealing with the use of coal combustion residue in road construction.

By pooling our funds and drawing on the expertise of both the Federal Government and State institutions, we can derive maximum benefit from a limited number of dollars. We have been very pleased with the initiative shown by States in pursuing this kind of cooperative effort, and I have instructed my staff to work aggressively in identifying similar opportunities for cooperation with additional States.

Mr. Chairman, I hope that, in our discussion this afternoon, we can present a convincing case that both our program and budget are technically prudent and fiscally sound. We hope to show that the budget will be effective in continuing the significant advances that have been made in fossil energy technology in the last several years.

Mr. Chairman, that completes my opening statement. I will be pleased to attempt to answer any questions the subcommittee may have.

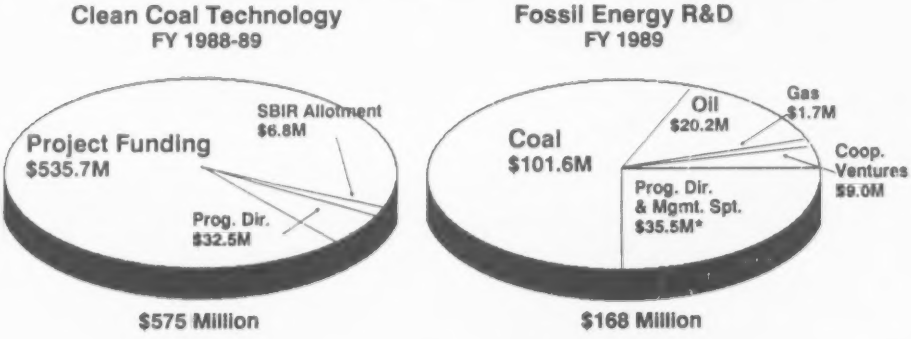
[The prepared statement of Mr. Wampler follows:]

Statement of
J. Allen Wampler
Assistant Secretary for Fossil Energy
U.S. Department of Energy
to the
Subcommittee on Energy Research and Development
Committee on Energy and Natural Resources
U.S. Senate
April 28, 1988

Continued implementation of the President's expanded clean coal technology program undergirded by a sound coal research and development (R&D) effort, a new emphasis on the enhanced recovery of oil, and the initiation of a two-phase cooperative R&D venture program highlight the Administration's FY 1989 fossil energy technology budget request. The following testimony describes these key elements of the budget request as well as providing individual fact sheets on each budget item contained in the proposed Fossil Energy program.

Introduction

The two major components of the Department of Energy's fossil energy technology program are (1) the Clean Coal Technology Program, which provides cost-sharing for large-scale, near-commercial demonstrations of emerging coal-based technologies, and (2) a diverse array of more fundamental, smaller-scale research and development efforts in coal, oil and unconventional natural gas. The two programs, depicted below with their major funding components, are complementary efforts – the more fundamental R&D efforts generating the new



*Includes Capital Equipment

concepts that are too high-risk or long-term for private sector financing alone, while the Clean Coal Technology Program is providing matching funds to industry to demonstrate the most promising coal concepts emerging from the nation's research and engineering laboratories.

The FY 1988-89 budget for the Clean Coal Technology Program ($50 million in FY 1988 and $525 million in FY 1989) reflects the appropriations approved by Congress in Pub. L. 100-202 for the first two years of the President's proposed five-year program. As will be described in this testimony, the Administration proposes to restore reductions made by Congress in the initial funding level by requesting advanced appropriations of $1.775 billion for FY 1990, 1991 and 1992 to ensure the federal government's full amount of the President's March 1987, $5 billion, five-year clean coal commitment ($2.5 billion of which is the federal share).

The $168 million funding request for the Fossil Energy R&D program ($167 million when a proposed $1 million offset is included) is a 53% reduction from the $354 million appropriated in FY 1988. The funding request is $17 million **higher** than the fiscal year 1988 *request*. As shown by the chart below, six of the nine major categories in the Coal program show proposed FY 1989 increases over their comparable FY 1988 requested levels. The Enhanced Oil Recovery program would increase by more than 75 percent over the department's FY 1988 requested amount. Given current fiscal constraints, we believe the FY 1989 budget request for Fossil Energy R&D is both technically prudent and fiscally sound.

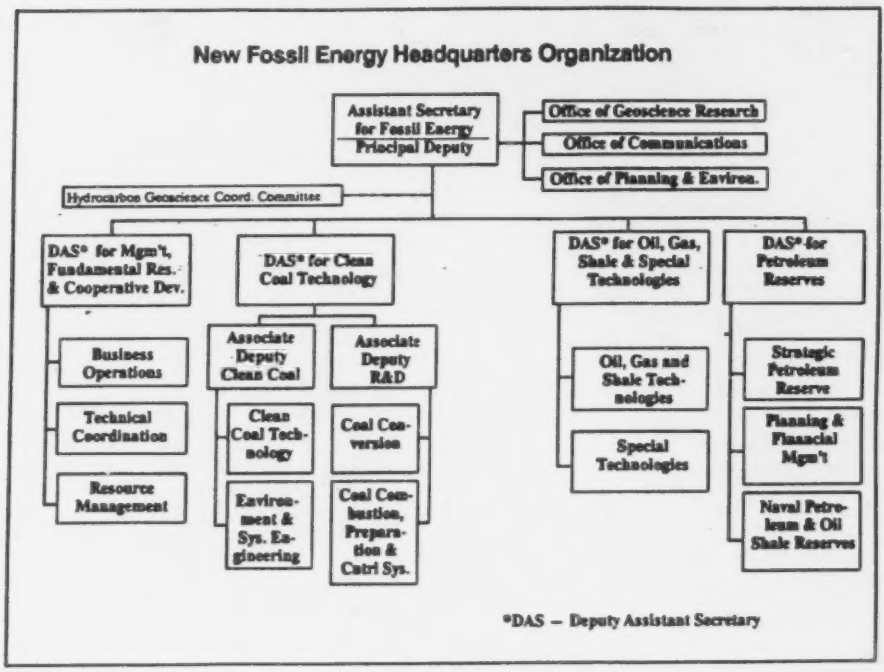
FOSSIL ENERGY RESEARCH AND DEVELOPMENT

	FY 1988 Request	FY 1988 Approps	FY 1989 Request
COAL			
Control Technology & Coal Preparation	$ 29.69	$ 43.62	$ 31.49
Advanced Research & Technology Development	20.75	24.94	21.41
Coal Liquefaction	9.50	27.13	10.30
Combustion Systems	21.09	25.17	17.42
Fuel Cells	6.58	34.20	6.63
Heat Engines	8.30	17.95	9.00
Underground Coal Gasification	0	2.78	0.27
Magnetohydrodynamics	0	35.00	0
Surface Coal Gasification	5.80	22.99	5.03
Subtotal, Coal	101.70	233.77	101.55
PETROLEUM			
Advanced Process Technology	2.00	3.43	2.17
Enhanced Oil Recovery	9.30	16.54	16.98
Oil Shale	0.96	9.50	1.04
Subtotal, Petroleum	12.26	29.46	20.19
GAS			
Unconventional Gas Recovery	1.60	10.53	1.73
Program Direction & Management Support			
Program Direction	38.44	61.84	34.78
Federal Inspector - Alaskan Gas Pipeline	0.23	0.23	0.25
Subtotal, Prog. Dir. & Mgm't Spt	35.70	62.08	35.03
Plant & Capital Equipment			
Capital Equipment	0.48	0.48	0
Construction	0.0	17.75	0.50
Subtotal, Plant & Capital Equip.	0.48	18.23	0.50
Cooperative Ventures	4.50	0	9.00
Offsets	-6.10	-27.10	-1.00
Total	$149.65	$326.98	$167.00

Fossil Energy Organization

To implement the expanding Clean Coal Technology Program and to ensure that it remains closely aligned to the ongoing related coal R&D programs, significant changes were made in the Office of Fossil Energy's headquarters organization effective on February 29, 1988. The revised organization also realigns several supporting functions within the organization to reflect more accurately the day-to-day operations of the program.

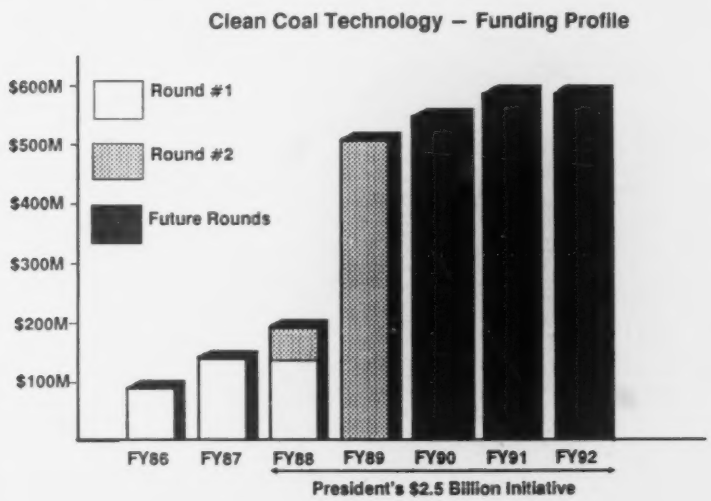
Simultaneously with the organizational restructuring, several senior- level Fossil Energy management officials have been given new assignments within the headquarters organization. These changes will help to ensure that the Office of Fossil Energy benefits from new ideas and management approaches and that expertise gained in one research area can be transferred and applied in other programs. The new Fossil Energy organization is depicted below:


New Fossil Energy Headquarters Organization
Assistant Secretary for Fossil Energy Principal Deputy
Office of Geoscience Research
Office of Communications
Office of Planning & Environ.
Hydrocarbon Geoscience Coord. Committee
DAS* for Mgm't, Fundamental Res. & Cooperative Dev.
DAS* for Clean Coal Technology
DAS* for Oil, Gas, Shale & Special Technologies
DAS* for Petroleum Reserves
Business Operations
Technical Coordination
Resource Management
Associate Deputy Clean Coal
Associate Deputy R&D
Clean Coal Technology
Environment & Sys. Engineering
Coal Conversion
Coal Combustion, Preparation & Cntrl Sys.
Oil, Gas and Shale Technologies
Special Technologies
Strategic Petroleum Reserve
Planning & Financial Mgm't
Naval Petroleum & Oil Shale Reserves
*DAS – Deputy Assistant Secretary

Key Elements of the Budget Proposal

Innovative Clean Coal Technology - The President's commitment on March 18, 1987, to request the full amount of funding recommended by the U.S.-Canadian Special Envoys on Acid Rain placed this nation on an aggressive course toward becoming the world's showcase of new, highly efficient, clean-burning coal technologies. The Innovative Clean Coal Technology Program would feature a sequence of competitive solicitations between fiscal years 1988 and 1992. The staggered timetable of solicitations will encourage new, potentially improved clean coal concepts to continue their development progress and to be considered in future competitions.

The $2.5 billion (federal share), five-year program proposed by the President incorporates a portion of, and builds onto, an ongoing $400 million effort approved by Congress in FY 1986, as shown by the chart below. The initial effort (FY86-88) has, to date, resulted in the successful negotiation of seven clean coal demonstration projects with a total value in excess of $757 million (the federal share projected to be $227 million). Four additional projects are being negotiated to complete the $400 million "first round" competition. (As the chart shows, the President's five-year program includes $150 million in FY 1988 funding applied in Round #1.)



The funding level requested by the Administration last year to implement the FY 1988-89 portion of the President's initiative was $850 million. Congress approved $575 million, of which $535.7 million will be made available in matching funds for cooperative agreements (the remainder is required for program direction and statutory requirements). DOE issued a solicitation on February 22, 1988, to begin the initial round of the expanded clean coal competitive program. Proposals are due on May 23, 1988, and candidate projects will be selected on or before the Congressionally directed deadline (in October).

The President remains committed to implementing the full $5.0 billion clean coal program within the five years recommended by the Special Envoys. This was reemphasized in a White House statement issued on January 23, 1988. Accordingly, the department is requesting that the remaining $1.775 billion be made available as an advanced appropriation in FY 1989 to be used for subsequent solicitations in 1990 through 1992 ($575 million to be made available in FY 1990, $600 million in FY 1991 and $600 million in FY 1992).

Continued Coal Research and Development – The FY 1989 budget proposal also maintains a solid core of coal-related research and development. This program, in many respects, provides the "seed money" for advances in knowledge and technical concepts that might ultimately lead to new breakthroughs and innovations in coal technology. While the annual funding level is smaller in comparison to the Clean Coal Technology Demonstration program, the R&D program is of equal importance.

Projects financed under this program are typically smaller in scale, and many are carried out in academic and private sector research laboratories (in contrast to the large demonstration projects that comprise the Clean Coal Technology Program). The value of this more fundamental program, however, is reflected in the significant advances it has fostered in the last decade. For example, since 1980, the coal R&D program has stimulated the development of:

- The **fluidized bed combustion** technique, now commercially deployed in the large industrial sector and gaining a foothold in the utility sector, including commercial-scale projects being financed in the Clean Coal Technology Program;
- **High-temperature gas cleanup** techniques that characterize "2nd-generation" gasification-combined cycle now being demonstrated in the Clean Coal Technology Program;
- The **coal-oil coprocessing** concept, originally studied in the Advanced Research and Technology Development Program, and now being demonstrated in the Clean Coal Technology Program as an economical "bridge" to the future production of synthetic liquids from coal;
- **Coal-slurry mixtures**, also originally studied in the Advanced Research and Technology Development Program, which will likely be a key fuel form for such concepts as the coal-fired diesel and turbine;
- **Underground coal gasification** which has moved from small scale development to the threshold of commercial demonstration during the last decade;
- A new array of **more effective and more economical pollution control devices**, such as electron-beam and copper oxide flue gas scrubbing, and **advanced coal preparation techniques**, many of which rely on such advances as ultrasonic grinding; and
- New insights into potentially revolutionary concepts in **microbial-based coal desulfurization** and conversion.

These advancements will help shape the future of coal technology in the 21st Century. The proposed FY 1989 budget will build on this solid base of technological progress.

In FY 1989 key research efforts will continue in physical and chemical/biochemical coal cleaning, in fine coal cleaning and in advanced flue gas and gas stream cleanup techniques. Work will also continue on novel catalytic, biological and other approaches to coal liquefaction, on benchscale development of coprocessing and/or staged liquefaction, and on the conversion of coal-derived gaseous feedstocks to liquid fuels. Coal gasification research will continue with ongoing efforts in such areas as hot gas desulfurization in entrained flow gasifiers, zirconia oxygen separation, low-energy consumption hydrogen separation and mild gasification.

New coal combustion techniques will also continue to be studied with a focus on small scale atmospheric fluidized bed concepts, on key elements of pressurized fluidized bed technology, on advanced, non-fluidizing combustors for industrial, residential and commercial use, and on the transport, handling and combustion of coal-based slurry fuels. The FY 1989 budget also continues development of integrated coal-based gas turbine and diesel engine systems, although the number of private contractors in the program would be reduced. Fuel cell funding would concentrate on resolving remaining technical uncertainties in the molten carbonate technology and continuing the development of the solid oxide technology.

Sufficient funds either exist in the FY 1988 budget or are included in the FY 1989 request to complete several key research efforts, including the Gravimelt coal cleaning process, the fluid bed copper oxide flue gas cleanup technology, the staged coal liquefaction concepts tested at Wilsonville (AL), the liquid phase methanol synthesis technique tested at LaPorte (TX), phosphoric acid fuel cell development, a three-year underground coal gasification field test effort in Wyoming, and the Waltz Mill (PA) integration tests of gasification and hot gas clean-up. As in previous Administration requests, the department is recommending that federal support be withdrawn from the multiyear magnetohydrodynamics (MHD) development effort due to its unaffordable costs, particularly given the diversity of technological options now becoming available to industry.

Enhanced Oil Recovery Initiative -- Continued advance of oil production technology is vital to this country. Regulatory reform, tax incentives and other financial measures will not resolve the fact that nearly two-thirds of our oil wealth is inaccessible through conventional recovery. Our target must be the approximately 300 billion barrels of domestic oil that cannot be recovered with today's technology. Much of this oil cannot be moved by conventional means (immobile) or is mobile but has been bypassed by current production methods.

To address this substantial and inviting energy target, the FY 1989 budget proposal contains an initiative to broaden the department's ongoing Enhanced Oil Recovery (EOR) Program. Several EOR research efforts have been reoriented toward shorter-term objectives, reflecting the current inability of the petroleum industry to finance this type of research on its own. New program elements have been added, some of which will be initiated in the remaining months of FY 1988. Included will be an effort to characterize a broad spectrum of the nation's oil reservoirs to gain a better, quantitative understanding of their "anatomy" -- their structures, geometries, compositions and how they respond to fluid injection. Also included will be selected field tests, environmental research, and exploratory efforts in oil mining and new concepts such as microbial-based recovery techniques. A strong geoscience component will be included along with other fundamental chemical, physical and thermodynamic studies.

The enhanced oil recovery initiative emerged from months of discussions with oil company officials, academic researchers, trade associations and state agencies. We believe we have crafted a program that represents a consensus approach recommended by these private and public sector experts. The budgetary result of this new emphasis in petroleum recovery is that the department's FY 1989 request for EOR is higher than any comparable request since FY 1982, as shown by the funding chart below:

Unconventional Gas Recovery -- The $1.7 million requested for research in the recovery of unconventional natural gas is sufficient to permit the department to assess the results of significant field tests and research efforts that have occurred in this program during the last five to six years, and to continue in-house, geoscience-oriented gas research. The recently completed Multiwell Experiment in the tight gas sand formations of Colorado has provided a wealth of new information which is now being documented. A directionally drilled, horizontal borehole test in an Eastern gas shale deposit in West Virginia has similarly generated substantial information that must be assessed before further research directions are determined. Within the geoscience focus of the proposed FY 1989 unconventional gas program, research will continue in gas hydrates and other long-range gas resources.

Cooperative R&D Ventures -- The FY 1989 proposal for a cooperative R&D venture program is an outgrowth of a concerted effort to obtain the private sector's advice and opinion. In contrast to previous proposals in this area, the FY 1989 initiative reflects greater consideration of funding priorities and on program goals and funding requirements in future years.

The FY 1989 proposal envisions the start of a two-phase program. The first phase would build on experiences gained from a pilot cooperative venture activity supported by Congress in FY 1988 ($1 million). It would require $9.0 million in FY 1989 funding and a total of $27 million over an estimated four year period. Highest priority in this initial phase would be given to ventures that would increase the effective domestic resource base for moderately-priced liquid and gaseous fuels. If funds remain available, additional projects would be selected that could increase the contribution of coal by improving its environmental, technical and economic performance in industrial and commercial applications now dominated by oil and gas. A second phase of cooperative R&D ventures would be added beginning in FY 1990 requiring additional funding.

As in previous DOE budget requests for cooperative R&D venture funding, the program would enable the department to join private sector sponsors in the formation of joint ventures that address precompetitive stages of fossil energy technology development. Also consistent with previous proposals, the non-federal venture partners would contribute more than 50 percent of the venture funding. The cooperative ventures would be structured in such a way as to return to the U.S. Treasury the federal contributions if a venture ultimately leads to successful application of the R&D products.

The following pages describe the individual elements of the FY 1989 Fossil Energy budget request.

INNOVATIVE CLEAN COAL TECHNOLOGY PROGRAM

FUNDING ACTIVITIES	(Dollars in Millions) (Parenthesis indicate Round #1) FY 1987	FY 1988	FY 1989	% Change from FY 1988
Cooperative Agreements (Non-Add)	($145.3)	($145.3)	0.0	(-100.0%)
(New BA)	0.0	$31.1	$504.6	+1,522.2%
Program Direction				
(Non-Add)	($2.0)	($2.0)	0.0	(-100.0%)
(New BA)	0.0	18.5	14.0	-24.3%
Small Business Innovation Research (Non-Add)	(1.8)	(1.8)		
(New BA)		0.4	6.4	
Total (Non-Add)	**($149.1)**	**($149.1)**	**(0.0)**	
Total (New BA)	**0.0**	**50.0***	**$525.0**	**+950.0%**

* Total Appropriation for FY 1988 is $199.1 M.

Background

- The goal of the CCT Program is, as stated in Pub. L. 99-190, "for the purposes of conducting cost-shared clean coal technology projects for the construction and operation of facilities to demonstrate the feasibility of future commercial operation." The Administration proposes to expand the existing program to support the Joint Envoys recommendations on the demonstration of innovative control technologies (i.e., the ICCT Program) over a five year period.

- The FY 1988 budget request included the initial increment of President's March 1987 commitment to requested $2.5 billion in federal funding over a five-year period for innovative control technology demonstration to be matched at least with 50 percent cost sharing by project sponsors.

- Specifically, an additional $50 million was appropriated in FY 1988 and $525 million for FY 1989.

- The remaining $1.775 billion is requested as an advanced appropriation in FY 1989 to be used for subsequent solicitations with $575 million becoming available in FY 1990, $600 million in FY 1991 and $600 million in FY 1992.

- The next solicitations, including the one issued February 22, 1988, will provide financial assistance awards for projects that employ technologies capable of retrofitting or repowering existing facilities.

FY 1989 BUDGET (AS APPROPRIATED IN FY 1988)	Dollars in Millions
• **CCT-1 Cooperative Agreements (Round #1)**	
- Complete construction on many projects and initiate or continue operational test program for several development efforts utilizing prior year funding. (FY 1988 - $147.1M)	$ 0.0
• **ICCT Cooperative Agreements (Round #2)**	
- Complete negotiations and initiate projects resulting from the new solicitation for financial assistance that will focus on retrofit or repowering projects. (FY 1988 - $31.5M)	504.6
• **Proposed funding for Small Business Innovation Research** (FY 1988 - $2.2M)	6.4

	Dollars In Millions
FY 1989 Budget (con'd)	
• **Program Direction**	
- Continue support of operational test program projects in first CCT solicitation using prior year funding. (FY 1988 - $5.8M)	0.0
- Continue efforts to prepare necessary evaluations, status reports, presentations, etc. as may be required to describe the expanded program and its progress to accomplishing the existing as well as added objectives. Continue project technology, market assessments required to evaluate and direct the greater number of projects selected to demonstrate innovative control technologies. Continue analysis of project data and results to ensure consistency with intent of Special Envoy's Report and program objectives. (FY 1988 - $8.0M)	5.9
- Continue environmental assessment studies and operational monitoring programs for projects selected in the initial CCT solicitation using prior year funds. Continue expanded environmental evaluation and data acquisition program required to implement NEPA requirements for each of the increased number of projects as well as the expanded program. (FY 1988 - $4.8M)	3.9
- Provide salaries, benefits, travel expenses, etc. for 58 FTEs (FY 1988 - $4.0M)	4.2
Total FY 1989	**$525.0**

COAL R&D

CONTROL TECHNOLOGY & COAL PREPARATION

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Research	$ 1.1	$ 2.0	$ 1.8	-10.0%
Coal Preparation	11.0	15.8	9.9	-37.3%
Flue Gas Cleanup	12.9	14.5	13.0	-10.3%
Gas Stream Cleanup	13.1	9.9	5.4	-45.4%
Waste Management	0.9	1.4	1.4	0.0%
Total	**$39.0**	**$43.6**	**$31.5**	**-27.8%**

Background

- Advanced Research, generic and fundamental in nature, is conducted on processes used to separate constituents such as ash, sulfur and nitrogen oxides in coal fuel streams before, during and after combustion.
- **Coal Preparation** is directed toward the development of advanced coal cleaning technologies that will reduce the ash and sulfur content of U.S. coal so that the product can be formulated into a high quality fuel that could replace oil and/or gas and reduce environmental emissions of suspected acid rain precursors from coal-fired boilers in both new and retrofit applications. Research is conducted in three broad areas: (1) physical treatment and cleaning; (2) chemical/biological pretreatment and cleaning; and (3) engineering support and ancillary operations.
- **Flue Gas Cleanup** addresses the removal of pollution causing contaminants from fossil fuel fired systems to meet current and projected environmental standards that could serve to limit the utilization of fossil fuels. Efforts will be focused on research and development of processes for the removal of NO_x, SO_x, and particulates, both for utility and industrial applications.
- **Gas Stream Cleanup** includes the technology for removal of contaminants from gasifier and combustor process streams prior to utilization in coal conversion systems. Both hardware and environmental protection are key concerns. Applications include PFB combustors, integrated gasifier combined cycle turbines, direct coal-fired turbines, coal-fueled diesels and fuel cells.
- **Waste Management** focuses primarily on waste sampling and characterization from coal preparation and emerging technology wastes.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Advanced Research**	
Continue fundamental research on processes used to separate constituents in coal-based fuel streams. Continue program management support. (FY 1988 - $2.0M)	$ 1.8
• **Coal Preparation**	
Continue research and explore new concepts for physical and chemical/biochemical coal cleaning. Continue research on new technologies for controlling emissions from pre-NSPS utility boilers. (FY 1988 - $6.3M)	4.9

FY 1989 BUDGET (cont'd)	Dollars In Millions
• **Coal Preparation (cont'd)**	
- Continue DOE/EPRI testing of most promising advanced concepts for fine coal cleaning. (FY 1988 - $2.2M)	2.1
- Continue in-house research on advanced physical and chemical coal cleaning concepts. Continue organic sulfur chemistry. Characterize feed coal and coal cleaning products, and study the role of surface functional groups in coal treatment. Continue program management support. (FY 1988 - $2.6M)	2.9
- Completed or discontinued activities: low rank coal beneficiation, Gravimelt project, and coal cleaning research at SIU and Ames Lab (FY 1988 - $4.65M)	0.0
• **Flue Gas Cleanup**	
- Complete research on TUNG scrubbing process. Participate in EPRI high sulfur coal test facility Continue spray dryer and in-duct technology development and systems integration studies for low cost duct injection. (FY 1988 - $3.3M)	2.9
- Continue research on advanced NO_x/SO_2 chemistry and systems modeling. Conduct economic assessments for scaleup. (FY 1988 - $3.2M)	2.9
- Continue advanced NO_x control research. (FY 1988 - $0.3M)	1.2
- Complete fluidized bed copper oxide proof-of-concept evaluation. Continue moving bed process evaluation. (FY 1988 - $1.5M)	2.2
- Continue research on most promising advanced flue gas processes for removal of SO_2 and NO_x at larger scale. (FY 1988 - $1.9M)	2.0
- Continue research on fine particulate control in coal-fired boilers. Initiate larger scale tests of fine particulate control technology. (FY 1988 - $0.8M)	1.0
- Continue research on enhanced mass transfer for duct injection. (FY 1988 - $0.5M)	0.5
- Continue technical and program management support. (FY 1988 - $0.3M)	0.3
- Completed or discontinued projects: research on dry sorbent SOx control, advanced separation technolgy, Glo-Klen boiler tests, and NOx/SOx spray dryer. (FY 1988 - $1.4M)	0.0
• **Gas Stream Cleanup**	
- For Pressurized Fluidized-Bed Combustion, complete long-term test of ceramic cross flow filter. (FY 1988 - $0.2M)	0.3
- For Integrated Gasification Combined Cycle, complete subpilot scale evaluations for cross flow filter and construction of desulfurization tailgas recycle to fixed-bed gasifier test facility; continue testing sulfur control devices at bench scale and development of novel sorbents and novel reactors. (FY 1988 - $4.3M)	3.0
- For Direct Coal-Fired Turbines, continue subpilot scale testing of acoustic agglomeration and development of integrated low emissions concepts. (FY 1988 - $2.3M)	1.8
- Continue systems analysis and program management support (FY 1988 - $2.4M)	0.3
- Completed or discontinued projects: MCFC tolerance assessment (FY 1988 - $0.6M)	0.0

- **Waste Management**

  - Continue sampling and characterization of organics and metals in solid wastes, and multi-site field monitoring of disposed wastes. Complete waste management systems analysis. (FY 1988 - $1.0M) — 1.2

  - Continue characterization of wastes, waste-related data base maintenance, and program management support. (FY 1988 - $0.2M) — 0.2

Total FY 1989 — **$31.5**

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Coal Utilization Science	$ 4.9	$ 4.5	$ 3.1	-31.1%
Materials and Components:				
Materials	6.8	6.5	5.1	-21.5%
Components	1.7	2.0	1.5	-25.0%
Subtotal, Materials and Components	$ 8.5	$ 8.5	$ 6.6	-22.3%
Technology Crosscut:				
Environmental Activities	2.2	2.4	2.6	+8.3%
Technical and Economic Analyses	2.0	1.5	2.6	+73.3%
Technology Base Synthesis	1.8	0.0	0.0	
International Program Support	0.0	0.0	0.7	
Instrumentation and Diagnostics	1.7	1.5	1.3	-13.3%
Bioprocessing of Coal	0.0	1.0	0.2	-80.0%
Subtotal, Technology Crosscut	$ 7.7	$ 6.4	$ 7.4	+15.6%
University/National Laboratory Coal Research:				
University Coal Research	5.5	5.5	3.9	-29.0%
University/National Laboratory Cooperative Program	0.0	0.0	0.4	
Subtotal, University/National Cooperative Program	$ 5.5	$ 5.5	$ 4.3	-21.8%
Total, Advanced Research and Technology Development	**$26.6**	**$24.9**	**$21.4**	**-14.1%**

Background

- The Advanced Research and Technology Development (AR&TD) Program is directed toward the scientific and technical areas that underlie the development of all fossil energy technologies.

- The AR&TD coal utilization science program focuses on mission-oriented fundamental research to increase understanding of the mechanisms of direct coal utilization.

Background (con'd)

- The AR&TD Program includes generic studies of materials and components and investigations of instrumentation concepts in environments associated with advanced coal technologies.
- The AR&TD Program undertakes feasibility investigation and exploratory research of novel concepts in coal conversion and utilization.
- The AR&TD Program differs from the Fossil Energy line programs; the latter have an end-item technology development orientation while AR&TD's mission is to pursue generic research in support of all Fossil Energy coal line programs. It addresses fundamental scientific and engineering problems that are barriers to Fossil Energy technological goals. The AR&TD program is unique in that it is directed to specific scientific and technical areas which are closely connected to long-range Fossil Energy objectives.
- Part of Direct Utilization funding was transferred to Advanced Research within Control Technology and Coal Preparation, Combustion Systems and Fuel Cells to comply with FY 1988 Congressional direction.

FY 1989 BUDGET REQUEST	Dollars in Millions
• Coal Utilization Science	
- Continue, at a reduced level, investigations of the formation, transformation and characterization of fuel and combustion product species; coal devolatilization, pyrolysis and volatile char oxidation; and radiant heat transfer. Continue, at a reduced level, studies specific to low-rank coal. Includes in-house research performed by METC and PETC. Continue to fund technical and program management support. (FY 1988 $4.5M)	$ 3.1
• Materials	
- Continue research on advanced steam cycle alloys, mechanisms of erosion and corrosion, ceramics composites, and advanced aluminides. Continue development of superconducting oxides. Continue to fund technical and management support. (FY 1988 - $6.5M)	5.1
• Components	
- Continue efforts initiated in FY87 for controllable letdown and alternate flow concepts. Initiate low pressure turbine flow control, nozzle development, and fluidic fuel injection for diesels and unique flow control concepts. (FY 1988 $0.5M)	0.6
- Continue fundamental research on solids transport. Continue to fund technical and program management support. (FY 1988 - $1.5M)	0.9
• Environmental Activities	
- Continue analyses of issues associated with air and water quality, solid waste disposal, and toxic substances. Continue support of occupational health, quality assurance, and safety compliances services. (FY 1988 - $1.7M)	1.9

FY 1989 BUDGET (Cont'd)	Dollars in Millions
• **Environmental Activities (cont'd)**	
- Continue research conducted under NAPAP with emphasis on quality assurance of data and analytical tools. (FY 1988 - $0.7M)	0.7
• **Technical & Economic Analyses**	
- Continue generic studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies that crosscut a number of FE programs, fund IEA/Coal Research Service activities. Continue coal technology export and linkage studies, planning, and evaluation. (FY 1988 - $1.5M)	2.6
• **International Program Support**	
- Conduct analyses, studies and technical evaluations of the IEA and bilateral agreement activities in which the FE program is involved. (FY 1988 - $0.0M)	0.3
- Support international collaborative research activities in Fossil Energy. (FY 1988 - $0.0M)	0.4
• **Instrumentation and Diagnostics**	
- Continue investigation of fiber optic sensor combustion probes and spectroscopic hot gas stream analysis techniques. Continue to fund technical and program management support. (FY 1988 - $1.5M)	1.3
• **Bioprocessing of Coal**	
- Continue, at a reduced level of effort, fundamental research in the bioprocessing of coal to gain an improved understanding of the reactions occurring when coal is desulfurized or converted to gases or liquids by biological means. Continue program and management support. (FY 1988 - $1.0M)	0.2
• **University Coal Research**	
- Support approximately 22 new grants at universities on the ongoing research topics including coal science, reaction chemistry, surface science, advanced process concepts, thermodynamics, engineering fundamentals, and environmental sciences; continue encouragement of collaboration between university and industrial researchers. (FY 1988 - $5.5M)	3.9
- Initiate one joint project involving collaboration of a national laboratory with universities in an area such as enzyme incorporated membrane processes, superconductivity applications in catalysis and beneficiation, supercomputers for molecule design, and laser-induced chemistry. Continue to fund technical and program management support. (FY 1988 - $0.0M)	0.4
Total FY 1989	**$21.4**

COAL LIQUEFACTION

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Research	$4.5	$6.1	$3.2	-47.5%
Direct Liquefaction	11.9	13.4	3.2	-76.1%
Indirect Liquefaction	6.2	6.6	2.8	-57.6%
Support Studies/Engineering Evaluation	1.4	1.0	1.1	+10.0%
Total	**$24.0**	**$27.1**	**$10.3**	**-62.4%**

Background

- This program supports basic and applied research to develop advanced technology for the production of synthetic liquid fuels from coal. The Department focuses upon several approaches to produce liquid fuels from coal: direct liquefaction, indirect liquefaction and novel approaches.

FY 1989 BUDGET REQUEST	Dollars in Millions
• Advanced Research	
- Continue research on: novel catalytic, biological and other approaches to coal liquefaction; improving the understanding of liquefaction processes; and, on physical, chemical and thermodynamic properties of fossil fuel liquids. (FY 1988 - $6.1M)	$ 3.2
• Indirect Liquefaction	
- Continue laboratory research at PETC investigating catalysts/reactor systems to efficiently convert coal derived gaseous feedstocks to gasoline, diesel, or jet fuels. Maintain limited laboratory research with industry and universities on alcohol and hydrocarbon fuel process concepts. (FY 1988 - $6.6M)	2.8
• Direct Liquefaction	
- Continue PETC in-house research. Maintain limited bench scale industrial research in coprocessing and/or staged catalytic liquefaction. (FY 1988 - $5.4M)	3.2
- Completed or discontinued projects: Wilsonville Liquefaction Facility (FY 1988 - $8M)	0.0
• Support Studies/Engineering Evaluations	
- Continue to develop solvent quality characterization and process evaluation information on advanced coal liquefaction processes. Continue novel catalystdevelopment and process studies at Sandia National Lab. (FY 1988 - $1.0M)	1.1
Total FY 1989	**$10.3**

COMBUSTION SYSTEMS

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Research	$3.3	$3.4	$2.1	-38.2%
Atmospheric Fluidized Bed Combustion	3.3	2.4	1.7	-20.6%
Pressurized Fluidized Bed Combustion	5.8	7.2	7.1	-1.4%
Advanced Combustion Technology	2.8	3.5	2.7	-22.9%
Alternative Fuels Utilization	3.2	3.7	3.8	+2.7%
Limestone Injection Multistage Burners	0.0	5.0	0.0	-100.0%
Total	$18.4	$25.2	$17.4	-31.0%

Background

- The Department of Energy has developed a program to increase the contribution and application of the nation's coal resources through the development of acceptable combustion systems and fossil-derived fuels for the marketplace.
- The programs within the overall Combustion Systems activity are: Advanced Research, Atmospheric Fluidized Bed (AFB), Pressurized Fluidized Bed (PFB), Alternative Fuels and Advanced Combustion Technology. Funding for the Limestone Injection Multistage Burner (LIMB) program, conducted by EPA is also part of this activity.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Advanced Research**	
- Continue studies to examine the fundamental aspects of combustion mechanisms, corrosive behavior and deposition of combustion products. (FY 1988 - $3.4M)	$2.1
• **Atmospheric Fluidized Bed Combustion**	
- Continue to conduct experimental and analytical erosion studies and AFBC development. (FY 1988 - $0.6M)	0.6
- Complete bench scale testing for one advanced concept for AFBC. (FY 1988 - $0.9M)	0.5
- Complete subsystem development testing for one concept within the Special Applications Program. (FY 1988 - $0.9M)	0.6
• **Pressurized Fluidized Bed Combustion**	
- Continue evaluation of PFB components, design alterations and changes in operating parameters to improve systems reliability, reduce costs and enhance environmental performance. (FY 1988 - $0.5M)	0.7

FY 1989 BUDGET (cont'd)	Dollars In Millions
- Continue modeling studies to predict tube erosion/ corrosion and linking criteria. Continue to determine mechanisms for tube wastage alloys for long term testing. Provide technical and program management support. (FY 1988 - $0.5M)	0.7
- Continue R&D at Morgantown Energy Technology Center on PFB economics, systems analyses, and combustion characterization. Continue technology and economic analysis assessments. Evaluate the use of "nonconventional" sorbents in advance PFB systems. (FY 1988 - $1.9M)	1.7
- Continue Advanced Concepts Phase II development and maintain project schedule and scope by testing key critical process components such as the circulating bed required to confirm proof-of-concept. (FY 1988 - $3.6M)	4.0
- Completed or discontinued projects: Grimethorpe follow-on efforts (FY 1988 - $0.5M)	0.0
• **Advanced Combustion Technology**	
- Continue the base program for the development of the most promising advanced combustion systems for retrofit, light industrial, commercial and large residential applications. (FY 1988 - $2.7M)	2.0
- Continue in-house activities including combustion and system characterization of coal based fuels. This activity also includes data base development for technology transfer to the private sector. Provide technical and program management support. (FY 1988 - $0.8M)	0.7
• **Alternative Fuels Utilization**	
- Continue identification, formulation and characterization of coal-based fuels in support of the advanced combustion systems program. This activity includes transport, handling and storage studies, and combustion characterization of beneficiated coal based fuels. Continue project management support and international cooperative research. Assess and test deeply beneficiated coals for retrofitting large pre-NSPS coal-fired boilers for acid rain control. Provide technical and program management support. (FY 1988 - $3.7M)	3.8
• **Limestone Injection Multistage Burners**	
- No activity. (FY 1988 - $5.0)	0.0
Total FY 1989	**$17.4**

FUEL CELLS

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Research	$ 1.3	$ 1.5	$ 1.0	-33.3%
Phosphoric Acid Systems	15.5	13.2	0.0	-100.0%
Molten Carbonate Systems	7.6	11.1	3.5	-68.5%
Advanced Concepts	5.0	8.4	2.2	-73.8%
Total	**$29.4**	**$34.2**	**$ 6.7**	**-80.4%**

Background

- The objective of the Fuel Cells program is to support high risk, high payoff technology base development and to assist private industry in developing hydrocarbon fuel conversion technologies to increase the cost effective, efficient and environmentally acceptable use of conventional and alternative hydrocarbon fuels.
- Advanced research, fundamental and generic in nature, is conducted to better understand the basis of the underlying processes involved in fuel cell operation and to explore novel concepts.
- Phosphoric acid systems have reached a near-commercial technical status with large scale testing underway. The Department proposes that any further technology development should be the responsibility of the private sector.
- The technical feasibility of molten carbonate fuel cells operating at approximately 60 percent electrical conversion efficiency (natural gas to busbar) has been forecasted by single cell testing. The complexity and associated capital costs of advanced fuel cell systems are projected to be less than those for first generation phosphoric acid fuel cell systems.
- The solid oxide fuel cell is an advanced, high temperature solid state fuel cell that offers promise in electric utility and in cogeneration applications in industrial and commercial sectors.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Advanced Research**	
- Continue generic research in basic electrochemistry science (FY 1988 - $1.5M)	$ 1.0
• **Molten Carbonate Systems**	
- Continue development of three coal-fueled molten carbonate fuel cell (MCFC) stack technologies and initiate action to select competitively the most promising MCFC technology. (FY 1988 - $10.3M)	3.3
- Continue technology base research, coal gasification/MCFC system study, and program management support. (FY 1988 - $0.8M)	0.2
• **Advanced Concepts**	
- Continue development of solid oxide fuel cell (SOFC) technology for a multi-kW generator. (FY 1988 - $6.9M)	1.6

FY 1989 BUDGET (con'd)	Dollars in Millions
• **Advanced Concepts (cont'd)**	
- Continue evaluation of advanced concepts. Conduct coal gasification/SOFC system analysis and materials characterization and development. Continue program management support. (FY 1988 - $1.5M)	0.6
Total FY 1989	**$ 6.7**

HEAT ENGINES

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Gas Turbines	$ 9.0	$11.0	$ 6.8	-38.2%
Diesel Engines	3.1	7.0	2.2	-68.6%
Total	**$12.1**	**$18.0**	**$ 9.0**	**-50.0%**

Background

- The principal goal of this program is to establish technical data which will enable the private sector to assess the commercial viability of coal-fueled power conversion systems. The program focuses on key technical problems associated with substituting coal or coal-derived gaseous fuels for distillate fuels or natural gas in gas turbine and diesel power conversion systems.

- Applications for this technology include industrial cogeneration, combined cycle electric power generation, repowering of existing generating capacity, and both rail and marine transportation.

- The FY 1989 budget request for Heat Engines is believed to be appropriate given the need to reduce the Federal budget deficit. Because of fiscal constraints, it is not appropriate or necessary to fund multiple approaches in this program area.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Gas Turbines**	
- Continue coal-fueled gas turbine integrated systems testing with two contractors. (FY 1988 - $10.2M)	$ 5.8
- Evaluate coal-based liquids in METC pressurized combustor test stand and test gas cleanup device in METC gas turbine combustor. Continue program management support. (FY 1988 - $0.8M)	1.0
• **Diesel Engines**	
- Continue coal-fueled diesel engine integrated system tests with one contractor. Test novel injection combustion and wear from coal-water mixtures and new fuel forms in METC diesel engine test facility and investigate advanced diesel cycles in METC diesel rig. Continue program management support. (FY 1988 - $7.0M)	2.2
Total FY 1989	**$ 9.0**

UNDERGROUND COAL GASIFICATION

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Gasification Technology Development	$ 1.2	$ 1.7	$ 0.0	-100.0%
Environmental and Advanced Research	1.2	1.1	0.3	-72.7%
Total	$ 2.4	$ 2.8	$ 0.3	-89.3%

Background

- This program represents viable technologies for in situ conversion of coal to a cleaner burning, easily transportable gaseous fuel.
- Program is directed toward the definition of sufficient technical operational, and environmental parameters to allow industry to make decisions concerning the commercial development of the technology.

FY 1989 BUDGET REQUEST	Dollars in Millions
Continue environmental compliance, restoration, and reclamation activities at historical UCG test sites as required by law. (FY 1988 - $2.8)	$ 0.3

MAGNETOHYDRODYNAMICS (MHD)

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Proof-of-Concept Topping Cycle	$16.3	$21.4	$ 0.0	-100%
Proof-of-Concept Bottoming Cycle	7.1	8.6	0.0	-100%
Proof-of-Concept Seed Regeneration	0.2	0.9	0.0	-100%
Systems Studies, Supporting Research and Conceptual Design	2.9	4.1	0.0	-100%
Total	$26.5	$35.0	$ 0.0	-100%

Background

- The FY 1988 MHD program began the design, fabrication and testing of "proof of concept" systems in accordance with the June 1984 cost-shared multiyear program. Long duration "proof of concept" testing is needed for the advancement of the MHD technology to the retrofit demonstration stage. A retrofit demonstration stage is needed for the determination of subsequent commercial application.

FY 1989 BUDGET REQUEST	Dollars in Millions
No funds are requested for FY 1989. Since an estimated $172 million (in constant FY 1988 dollars) will be needed over the next five years to complete the "proof of concept" program, DOE believes the MHD program is not affordable in light of fiscal constraints, particularly considering other emerging options. (FY 1988 - $35.0M)	$ 0.0

SURFACE COAL GASIFICATION

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Research	$ 2.8	$ 2.7	$ 0.7	-74.1%
Systems for Power Production	14.4	11.2	0.9	-92.0%
Systems for Industrial Fuel Gas Production	1.2	1.4	0.8	-42.9%
Systems for Synthesis Gas Production	1.8	1.9	1.3	-31.6%
Systems for Coproducts Production	4.1	5.3	0.8	-84.9%
Great Plains Coal Gasification Project	0.4	0.5	0.5	0.0%
Total	$24.7	$23.0	$ 5.0	-78.3%

Background

- The coal gasification program is organized to foster the development of advanced gasifier systems for the production of: electric power, synthesis gas (for synthetic natural gas, indirect liquefaction, and chemical feedstocks), industrial fuel gas, and coproducts (simultaneous production of solids, liquids, and gases). This activity also provides for basic and fundamental research related to Surface Coal Gasification processes including studies of reaction mechanisms and chemistry. Finally, this program supports the continued management and monitoring of the Great Plains Project.

FY 1989 BUDGET	Dollars In Millions
• Advanced Research	
- Complete work on the biological conversion of coal to methane. Complete work on the mechanisms of ash agglomeration in fluidized bed gasifiers. (FY 1988 - $2.2M)	$ 0.6
- Complete work on separating hydrogen from synthesized gas using ion exchange membranes. Complete work on the factors controlling cleavage and restoration of bonds. Complete work on study of active carbon site distribution. (FY 1988 - $0.5M)	0.1
• Systems for Power Production	
- Continue studies on entrained flow reactors to reduce process severity and increase efficiency of gasification. (FY 1988 - $0.5M)	0.4
- Continue environmental sampling and analysis to characterize process and effluent streams. Provide technical and program management support. (FY 1988 - $0.2M)	0.1
- Continue development and testing of hot desulfurization in entrained flow reactor system for power generation. (FY 1988 - $2.8M)	0.4
- Completed or discontinued activities: GE project for application of hot gas desulfurization to integrated gasifier combined cycle systems and Waltz Mill pressurized fluidized bed gasifier with hot gas clean-up (FY 1988 - $6.9M)	0.0

FY 1989 BUDGET (Cont'd)	Dollars in Millions
• Systems for Industrial Fuel Gas Production	
- Continue development of economical methods for oxygen production for use in multi-ton/day plants. (FY 1988 - $0.4M)	0.2
- Continue operation of the fluidized bed reactor at METC as well as continuing support for the planning implementation, and application of the gasification data base. Provide technical and program management support. (FY 1988 - $0.6M)	0.6
- Completed or discontinued activities: hydrogen production from low-rank coal and waste water treatment studies (FY88 - $0.8M)	0.0
• Systems for Synthesis Gas Production	
- Continue engineering and technical support for the joint DOE/GRI program. (FY 1988 - $0.4M)	0.6
- Continue development of a novel concept for the separation of hydrogen from coal derived gas. (FY 1988 - $0.1M)	0.2
- Continue systems analysis and model development efforts. Provide technical and program management support. (FY 1988 - $0.2M)	0.5
• Systems for Coproducts Production	
- Conduct comparative slow and rapid heating rate experiments to establish a matrix of product yields and to investigate product options for coal-based fuels from mild gasification. (FY 1988 - $0.3M)	0.7
- Continue modeling analysis and system analysis. Provide technical and program management support. (FY 1988 - $0.2M)	0.1
- Completed or discontinued activities: research for high Btu defense fuels (FY88 - $0.5M)	0.0
• Great Plains Coal Gasification Project	
- Conduct environmental compliance activities. Complete post operations assessments and information archiving. Provide administrative closeout expenses. (FY 1988 - $0.5M)	0.5
Total FY 1989	**$ 5.0**

PETROLEUM

ADVANCED PROCESS TECHNOLOGY

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Advanced Exploratory Research	$ 3.3	$ 3.0	$ 1.7	-43%
Arctic and Offshore Research	0.5	0.4	0.5	+25%
Total	$ 3.8	$ 3.4	$ 2.2	-35%

Background

- The Advanced Process Technology (APT) Program pursues new concepts to achieve major increases in efficiency and cost reduction of recovery techniques for oil, gas, and oil shale. Research goals are:
  - to conduct fundamental research relevant to recovery of oil, gas and shale oil.
  - to pursue application of new concepts which may achieve major increases in the recovery of oil, gas and shale oil resources.
  - to develop a fossil energy-related knowledge base that will improve the economics of fossil fuel production in the Alaskan Arctic and expand the reserves.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Advanced Exploratory Research**	
- Continue a program of fundamental studies including cross-cutting research in petroleum chemistry focusing on structural characterization and determination of a structure-property relationship of heavy crudes, intermediate process streams, products, and byproducts. (FY 1988 - $0.8M)	$ 0.6
- Continue, at a reduced level, research on geoscience and extraction technology and development of advanced instrumentation to measure reservoir characteristics and thermal fronts. ($2.0M)	1.0
- Continue, at a reduced level, research on pollutants in aquifers adjacent to oil, gas, and shale in-situ recovery operations. Continue funding for technical and program management support. (FY 1988 - $0.2M)	0.1
• **Arctic and Offshore Research**	
- Continue generation and acquisition of research data on ice island motions and ice flow interactions with structures; continue Arctic/Offshore oil and gas research and information identification. Continue funding for technical and program management support. (FY 1988 - $0.5M)	0.5
Total FY 1989	$ 2.2

ENHANCED OIL RECOVERY

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Heavy Oil	$2.4	$3.7	$4.0	+8.1%
Light Oil	7.2	9.9	13.0	+31.3%
Tar Sands	1.6	2.0	0.0	-100.0%
Pilot Venture Program	0.0	1.0	0.0	-100.0%
Total Enhanced Oil Recovery	**$11.2**	**$16.6**	**$17.0**	**+2.4%**

Background

- Enhanced oil recovery represents a technology that can fill the gap between now and the critical time when the nation will likely rely more extensively on synthetic fuels (also being developed by our Oil Shale, Tar Sands, and Liquefaction programs).
- The Department of Energy has developed a program to conduct generic technology base R&D activities; develop fundamental knowledge that can lead to improved and new process concepts; and to assist industry in obtaining a better understanding of the mechanisms and behavior of advanced and novel EOR processes for the recovery of presently unrecoverable light oil, heavy oil and tar sand resources.
- FY 1989 funding will concentrate upon heavy and light oil recovery research. Developing advanced oil recovery techniques is a major initiative of the Fossil Energy R&D program for FY 1989.

FY 1989 BUDGET REQUEST	Dollars in Millions
• **Heavy Oil**	
. Continue basic research in mobility control mechanisms of steamflood additives. Define the mechanisms by which foam increases oil recovery and develop analytical and numerical models. Develop relative permeability and capillary pressure data. (FY 1988 - $0.4M)	$ 1.5
. Continue cooperative research with Venezuela on petroleum characterization and recovery studies and expand technical and analytical assessments related to geoscience and reservoir characterization. (FY 1988 - $0.2M)	0.5
. Continue a geoscience characterization program, research in novel extraction approaches to presently deemed unrecoverable, heavy oil resources, and fundamental studies of reservoir characteristics and injection fluid interactions. Provide technical and program management support. (FY 1988 - $1.5M)	2.0
• **Light Oil**	
. Continue a broad based program of research in light oil recovery techniques for reservoir description and conduct related planning, technical and analytical assessments. (FY 1988 - $3.6M)	4.2
. Continue a geoscience effort and reservoir characterization and related fundamental studies addressing definition of reservoir structure and composition. (FY 1988 - $2.5M)	3.7

FY 1989 BUDGET (cont'd)	Dollars in Millions
• Light Oil (cont'd)	
. Continue microbiological studies and explore the feasibility of other novel methods of extraction of residual oil resources. (FY 1988 - $1.0)	1.1
. Continue a research program that utilizes CO_2 and other gas recovery methods in a variety of situations to study and identify displacement mechanisms requisite to efficient, effective and predictable application of these techniques. (FY 1988 - $0.6)	1.8
. Continue industry/state cooperative work to rapidly demonstrate lab scale EOR concepts in mature fields. Develop retrofit technology to reduce stripper well costs. Provide technical and program management support. (FY 1988 - $1.9)	2.2
Total FY 1989	**$17.0**

OIL SHALE

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Oil Shale Technology Base	$ 7.7	$6.7	$0.7	-89.6%
Environmental Mitigation	3.2	2.8	0.3	-89.3%
Total Oil Shale	**$10.9**	**$9.5**	**$1.0**	**-89.5%**

Background

- Oil shale technology development represents the development of extraction and conversion processes designed to convert oil shale to a state of liquid fuels.
- The Department of Energy has developed a program to provide a sound technological basis for reduction of economic and environmental constraints to industrial development of the U.S. oil shale resources and to increase the amount of resources that may be used economically. The program will focus on basic research using reference shales to systematically study the chemistry, kinetics, and emissions related to eastern and western shale processing.

FY 1989 BUDGET REQUEST	Dollars in Millions
• Oil Shale Technology Base	
. Continue experiments with reference shales in various generic fast heat-up lab-scale retorts, with mechanistic modeling support. Continue developing a systems analysis capability as well as continuing development and maintenance of an oil shale data base. Provide technical and program management support. (FY 1988 - $2.8M)	$ 0.7

FY 1989 BUDGET (cont'd) — Dollars in Millions

- **Environmental Mitigation**

  - Continue analytical methods development, studies of mechanisms of pollutant generation and fate, process stream characterization, and development of an environmental data base. Conduct planning, technical, and analytical assessments. Provide technical and program management support. (FY 1988 - $0.3M) — 0.3

Total FY 1989 — $ 1.0

GAS

UNCONVENTIONAL GAS RECOVERY

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Eastern Gas Shales	$0.9	$ 2.3	$ 0.3	-87.0%
Western Tight Gas Sands	5.4	3.3	0.3	-90.9%
Environmental and Advanced Research	1.7	4.9	1.1	-77.6%
Total Unconventional Gas Recovery	**$8.0**	**$10.5**	**$ 1.7**	**-83.8%**

Background

- This program fosters the development of advanced technologies for the extraction of natural gas from currently unrecoverable gas resources by reducing the uncertainty surrounding the potential magnitude of reserves of the unconventional gas resources and the conditions under which they will be produced. The program will develop technologies to the point where concepts are proven and economics established.

FY 1989 BUDGET REQUEST — Dollars in Millions

- **Eastern Gas Shales**

  - Continue in-house support to maintain and update the technical data base and research with associated reservoir and stimulation models; continue systems analysis in support of production strategy development. (FY 1988 - $2.3M) — $ 0.3

- **Western Tight Gas Sands**

  - Continue in-house support to update predictive reservoir and stimulation models; expand technical data base. Continue systems analysis in support of production strategies and also forecasts of regional production patterns in light of multi-well results and reservoir heterogeneity. (FY 1988 - $3.3M) — 0.3

FY 1989 BUDGET (cont'd)	Dollars in Millions
• Environmental and Advanced Research	
- Continue in-house geologic, geophysical and geochemical studies in support of a program to explore deep source gas generation potential of organics subducted due to plate tectonic convergence. (FY 1988 - $0.2)	0.3
- Continue research to explore, on a fundamental basis, geophysical and geochemical properties of gas hydrates and to examine gas hydrate recovery strategies based on an understanding of the gas release mechanisms. Conduct in-house technology assessment of processes to convert natural gas to liquids. Provide technical and program management support. (FY 1988 - $4.6)	0.8
Total FY 1989	**$ 1.7**

COOPERATIVE R&D VENTURES

	(Dollars in Millions)			
FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Cooperative R&D Ventures	$0.0	$0.0	$9.0	n/a

Background

- The Administration proposes to initiate a multiyear two-phase program for cooperative research and development ventures in fossil energy technologies.
- The first phase would provide immediate support to those ventures which are currently ready to proceed, and would require approximately $27 million over an estimated four-year period.
- The design of the first phase could be based, in part, on experiences obtained from the pilot cooperative R&D venture activity considered under the Enhanced Oil Recovery program.
- The second phase, in which awards would be made in FY 1990, would support a subsequent set of ventures which will be defined and organized by potential participants in the intervening period. Additional funds beginning in FY 1990 would be required for this second phase.
- The FY 1989 budget request proposes $9,000,000 to enable the Department to join with private sector participants in the formation of cooperative research and development ventures which address precompetitive stages of fossil energy technology development, and in which the non-federal venture partners contribute over 50 percent of the venture funding.

FY 1989 BUDGET REQUEST	Dollars in Millions
• Cooperative R&D Ventures	
- Provide financial assistance awards for cost-shared cooperative R&D ventures that can ease the level of future oil imports by focusing on the development of technologies that satisfy mission objectives to increase the effective domestic resource base for moderately-priced liquid and gaseous fuels; and to increase the contribution of coal by improvements in environmental, technical and economic performance in industrial and large commercial applications currently dominated by oil and gas. Under the Phase I program, higher priority would be given to the first of the above two areas. (FY 1988 - $0)	$8.9
- Provide support for preparing and issuing Phase I solicitation and Phase II Statements of Interest. Monitor activities, and assist parties interested in establishing potential ventures. (FY 1988 - $0)	0.1
Total FY 1989	$9.0

PROGRAM MANAGEMENT & CAPITAL EQUIPMENT

PROGRAM DIRECTION & MANAGEMENT SUPPORT

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Headquarters Program Direction				
Salaries and Benefits	$ 8.0	$ 9.1	$ 8.4	-7.6%
Travel	0.6	0.5	0.3	-40.0%
Contract Services	3.0	4.4	1.0	-77.2%
Subtotal, Headquarters Program Direction	$11.6	$14.0	$ 9.7	-30.7%
ETC Program Direction				
Salaries and Benefits	$17.5	$19.0	$13.5	-28.9%
Travel	1.0	1.0	0.6	-40.0%
Contract Services	28.5	27.8	11.0	-60.4%
Subtotal, ETC Program Direction	$47.0	$47.8	$25.1	-47.4%
Federal Inspector for the Alaskan Natural Gas Transportation System	$ 0.2	$ 0.2	$ 0.2	0.0%
Total Program Direction	**$58.8**	**$62.1**	**$35.0**	**-43.6%**

Background

- This activity provides funding for salaries, benefits and overhead expenses for the management of FE programs at Headquarters and the Energy Technology Centers:

Background (cont'd)

- The Headquarters staff is responsible for overall program direction which implements DOE policy and communicates that policy to the Energy Technology Centers, sets program objectives, develops program plans and evaluates alternative program strategies, develops and defends budget requests to the Office of Management and Budget and to the Congress, approves procurement plans, monitors work progress, evaluates projects, approves revisions in work plans as required to attain program goals, and supports the new Office of Geoscience Research.

- The Energy Technology Centers support day-to-day project management functions for assigned programmatic areas including contract and National Laboratory monitoring, development and maintenance of project budget, procurement plans, and other activities related to program and site support.

- The Office of the Federal Inspector for the Alaska Natural Gas Transportation System is responsible for coordinating all Federal activities pertaining to the pipeline in order to assure timely, efficient, safe, and environmentally sound construction, including the assessment of developments in the world energy market, specifically the U.S. and Canadian oil and gas situation as they affect the Alaska Natural Gas Transportation System.

FY 1989 BUDGET REQUEST	Dollars In Millions
• **Headquarters Program Direction**	
- Provide funds for salaries and benefits of 125 full time-equivalent (FTE) personnel at Headquarters. This staff implements and communicates policy to the ETC's, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans, monitors work programs. (FY 1988 - $9.1M)	$ 8.4
- Provide funds for travel of 125 FTEs in support of the activities stated above. Both domestic and international travel is conducted. (FY 1988 - $0.5M)	0.3
- Provide for contractual services that are generic to the entire FE program. Included are items such as printing, computer services, technical support services, conferences, etc. (FY 1988 - $4.4M)	1.0
• **ETC Program Direction**	
- Provide funds for salaries and benefits of the ETC staff of 243 FTEs. Activities of the staff include contract and lab monitoring; development and maintenance of project, budget and procurement plans, and other activities related to program and site support. (FY 1988 - $19.0M)	13.5
- Provide funds for travel of 243 FTEs in support of the coordination of the above activities in the attainment of program goals, both on the domestic front and abroad. (FY 1988 - $1.0M)	0.6

FY 1989 BUDGET (cont'd)	Dollars In Millions
- Provide funds for facility operations, maintenance, finance and administrative support and other costs not appropriately chargeable to R&D projects, in support of this level of FTE's. (FY 1988 - $27.8M)	11.0
• **Federal Inspector for the Alaskan Natural Gas Transportation System**	
- Provide funds for administrative and support functions; continue to assess developments in U.S. and Canadian energy markets and maintain liaison with project sponsors, producers, other government agencies, State of Alaska and Canadian government. (FY 1988 - $0.2M)	0.2
Total FY 1989	$35.0

PLANT AND CAPITAL EQUIPMENT

(Dollars in Millions)

FUNDING ACTIVITIES	FY 1987	FY 1988	FY 1989	% Change from FY 1988
Capital Equipment	$ 1.6	$ 0.5	$ 0.0	-100.0%
Construction	1.8	17.7	0.5	-97.1%
Total Plant and Capital Equipment	**$ 3.4**	**$18.2**	**$ 0.5**	**-97.3%**

Background

- Capital equipment is purchased annually to replace obsolete equipment so that the Energy Technology Centers (ETCs) and the National Laboratories analytical capabilities are constantly being upgraded.
- General plant projects are essential to the safe, efficient operation of the ETCs and construction is dedicated to a number of improvements, alterations and additions at each of the ETCs.

FY 1989 BUDGET	Dollars In Millions
• **Capital Equipment**	
- No Activity. (FY 1988 - $0.5M)	$ 0.0
• **Construction**	
- Continue design of chemical engineering laboratories project at PETC. (FY 1988 - $0)	0.5
Total FY 1989	$ 0.5

Senator FORD. Mr. Secretary, I want you to know how much I appreciate your mentioning Kentucky in your statement there toward the end. There is only one disappointing thing about it, however: there are not enough of them.

Let me see if you can agree or disagree with this statement that in the last few years there has been an increasing emphasis on energy security. We all appear to be well-versed I think in the dangers of increasing dependence on foreign oil. One way to minimize this danger, of course, is to expand, as I said in my opening statement, the slate of technologies that use domestic resources. Can you agree with that statement?

Mr. WAMPLER. Certainly, Mr. Chairman.

Senator FORD. If so, then why have you proposed to make large and, in some areas, greater than 50 percent cuts in Federal R&D and the efforts in these particular areas?

Mr. WAMPLER. Well, I think, Mr. Chairman, I can answer that by talking about a couple of things, and I think we have to talk about them together.

If you look on the positive side, the Clean Coal Technology Program will certainly promote the increased use of what is truly our most abundant resource. And it will do it in a reasonably short time. If you look at the R&D budget, it is true that we have proposed a cut. As I said before, a large part of that cut is coming from projects that are closed out. It is simply an issue of affordability, and we try to balance the priorities, of course, in the administration of the budget, against that affordability.

But energy security, I would certainly agree with you, is a very important issue.

Senator FORD. The fiscal year 1989 funding request for coal and gas R&D is less than 50 percent of the fiscal year 1988 appropriation. In the petroleum area, with the exception of enhanced oil recovery, the proposed budget is significantly less than the current level of funding. It seems that last year's request was also less than what was eventually appropriated, less than 50 percent of what was appropriated.

Now, as you know, Mr. Secretary, this is not the first time that the administration has come in here with a very low request for R&D, and the Congress has restored funding in all these areas. Why don't you just ask for the full funding in the first place, and then we both look like winners? [Laughter.]

Mr. WAMPLER. Well, Mr. Chairman, that is a difficult question to answer.

Senator FORD. Thank you for the compliment. [Laughter.]

Mr. WAMPLER. In looking at the overall budget process that we go through in the Administration, and I find it, quite frankly, not unlike the one that the Congress goes through, we have to balance priorities. I think we try to do that with as much information as we can. And it is simply a matter of affordability. We try to take the approach of sending up a technically defensible budget, and, as I have said earlier, there always will be many more good project ideas and good projects than we feel we can afford.

Senator FORD. Well, let's just take this a step further then. I guess cuts are in the eye of the beholder, but it seems to me that you ought to get a message that, you know, you come up here and

you're going to cut it and we're going to put it back in. And we do put it back in, and you proceed. Like the fellow says, I vote no and take the money. You know, that's what happens here.

If you ask for what you say are your needs and are truly concerned about the deficit, then when you receive a much larger amount of funding, which the Congress has done, why don't you just propose a rescission and give the money back?

Mr. WAMPLER. Well, we do, Mr. Chairman, obey the law. When Congress passes the appropriation, it is very true that we do continue with the programs and spend the money. And we have in the past proposed rescissions. And, of course, they have not been acted on. So, that has been done in the past.

This year we sent up to the Congress a list of—I think we used the term "unaffordable projects" or some other term. But once the program levels are determined, we follow the law and implement the programs.

Senator FORD. I have been told up here by some people sitting at that table if you appropriate it, we ain't going to spend it. So, it seems to me that after we go through all this and we increase the amount and you go ahead and spend it—we want you to spend it or we wouldn't have voted that way—it just looks like, as I say, both of us could be winners.

In reading your testimony last night and again this morning, you provided us with information about the recent reorganization of the Office of Fossil Energy. How is this different from the previous organizational structure and what was the motivating factor leading to these changes?

Mr. WAMPLER. Well, the difference basically reflects a growing Clean Coal Technology Program more than anything else. We looked at the organization that we had, and we had a couple of concerns.

One concern was that, as the Clean Coal Technology Program grew, we did not want it to lose its interface with the research and development effort. So, we developed an organization in which we have one Deputy Assistant Secretary that heads up all coal technology with two Associate Deputies answering to this Deputy Assistant Secretary, one for Clean Coal Technology and one for Research and Development. We felt it was very important to have those answering to one person so that they would not lose sight of each other's program priorities.

The second reason that we did it was that we had implemented in the interim, from last year, a new Geosciences Office, and we felt with a growing program, that we simply needed to look at the entire organization and reorganize.

There was another aspect. I felt that some of our very excellent senior executive service managers had been in the same position for a very long time, and it would be very healthy for them to get out and get exposed to new programs, new horizons. The senior executive service is supposed to be a very mobile, flexible group of people, and I think they are. And I think some of these folks are very much enjoying their new assignments.

So, those basically were the reasons for the reorganization.

Senator FORD. Let's talk about cooperative R&D ventures and fossil fuel. Tell me basically what is the purpose of these ventures.

Mr. WAMPLER. Well, we have proposed these things I guess twice in our budget. Cooperative ventures are——

Senator FORD. You say you proposed them twice? In this budget, or last budget and this one?

Mr. WAMPLER. In the last budget.

Senator FORD. We rejected them last time, didn't we?

Mr. WAMPLER. Yes, they were rejected last time. We are proposing them again.

The difference in a cooperative venture and a normal R&D project is that the cooperative venture requires 50 percent cost-sharing with private sector partners. And that is plural, not a single partner, but other partners. It is important to note that we have said several times that this is in addition to our normal R&D program. What this simply does is it forces us to go out to the private sector to find out what ideas and areas they are interested in, and that interest is always very legitimate because, if they are willing to put up 50 percent of the funding, you can be certain it is something they do have interest in.

We went out across the country and had four public meetings with a great deal of interest in the private sector, and there still is a great deal of interest in the private sector. We would certainly ask the Congress to consider funding cooperative ventures in the future.

Again, I think it is important to note that this is in addition to our R&D program and would not be an area that would consume the R&D budget. It simply lets us get a little bit closer to the commercial stage than we do with our long-term, high-risk research.

Senator FORD. As I understand it, you presented a two-phase program for cooperative ventures with I think the priority being given to ventures that would increase the effective domestic resource base for moderately priced liquid and gaseous fuels. You state further that if funding is available, you would allocate it for projects to increase the contribution of coal in industry and commercial areas now being dominated by oil and gas.

Now, give me the rationale for these priorities.

Mr. WAMPLER. Well, for the rationale for the priorities, we have to go back to the last budget request, the FY 1988 budget request. We were beginning to feel that we were not putting perhaps sufficient funding into enhanced oil recovery. So, we decided to target the first set of cooperative ventures specifically for that kind of R&D. And the second priority was developed as we had intended to expand the program to cross-cut overall fossil fuel, just not the ones that were included in oil and gas.

So, that is simply a reflection of thinking that we had at the time, and it has just moved one step forward. We think now that they should cross-cut all areas of R&D.

Senator FORD. Well, let's get into a little more detail then with the clean coal technology program. Give me the status of clean coal I, if you will. Has work begun on any of the projects? When do you feel that you will be able to finish the negotiations with the remaining participants? I understand maybe you had two that were rejected, and you have gone into alternates and moved those in. It is awful hard to keep up with everything. So, try to bring me up to date on these. Will you please, sir?

Mr. WAMPLER. Certainly, Mr. Chairman.

There were nine projects originally selected in clean coal I. Seven were successfully negotiated. We had two that withdrew. We then went to our B list and selected four projects. Negotiations on those four are now underway. One is almost complete; the other three remain in negotiations.

We have, in case negotiations on any of these four projects fail to come to conclusion, five projects still remaining on the B list. Our milestones that we currently have are for negotiations to be completed by the end of the fiscal year on all of the four projects.

We have projects that have started. The seven are getting underway. Some have broken ground; some have not. One project is well underway. Three weeks ago we had the ground-breaking for the Tidd project in Ohio, which is one of the largest projects. So, it is well underway.

Senator FORD. DOE does appear to be optimistic about the proposals for the request in the innovative clean coal technology program. Do you have any indication about whether a majority of the projects will be retrofitting or for repowering technologies?

Mr. WAMPLER. Our feeling is that there will be a very healthy mix of each or both. We think that we will certainly get sufficient projects to more than spend the funding that we have available. Our indications are, at least tentatively, that it will be a good mix of both types of projects.

Senator FORD. Clarify for the Senator the recoupment provisions for the second solicitation.

Mr. WAMPLER. We attempted to develop a very simple formula for recoupment based in large part on what the private sector does in licensing and those sorts of things.

It was pointed out to us by one or two groups of people that were very interested in clean coal technology that that provision was unfair because it placed the burden of recoupment on the equipment owner or the equipment manufacturer. We subsequently made a revision in the recoupment requirement that allowed the private partners to suggest to us a recoupment plan that would at least equal the amount of money that the small percentage would have returned to the government, and also for the technology that would be subjected to recoupment to be mutually determined by the private participant and the Department of Energy.

In my opinion that went a long way to put the issue to rest. There was no complaint, however, to my knowledge, at all on the very small percentage of sales that the government had asked for. It was basically 2 and 3 percent of sales. So, I think we have gone a long way to solve the problem that was expressed by the private participants in recoupment.

Senator FORD. Well, let's get into something now. It is a strange kind of occurrence to me. It is hard to put my finger on it, but let me walk you through a logical procedure of events. In the case of a normal study, usually a report is written. Then a summary of that report is prepared, and finally a press release is issued.

So, on January 23, the President accepted the recommendation of his Task Force on Regulatory Relief. A summary of these recommendations was released a week later after the press conference. But a report has never been seen, and I understand it is not avail-

able. Tell me about this hidden report or lack thereof. That was January 23. You should have already had it over here. This is almost May. That is five months.

Mr. WAMPLER. Well, on January 23, the President did announce that recommendations in three general categories had been accepted from his Task Force on Regulatory Relief.

There is a report being prepared now by the Department of Energy that is in interagency concurrence right at this point in time. We expect it to be out within a couple of weeks. It is a report on the Clean Coal Technology Program that has as part of that report, the report of the Vice President's Task Force on Regulatory Relief, chaired by the Vice President. So, that is the format that this report will be distributed to the public in. And again, we are doing a minor revision on it right now. We expect that it will be out in a couple of weeks.

Senator FORD. You hope it will be out sometime this year then, don't you?

Mr. WAMPLER. Oh, we definitely have to have it out because the people who are bidding on Clean Coal II projects need that information in hand. So, we are trying to expedite it as much as we can.

Senator FORD. I don't want to belabor the point with you because I understand that you are a good soldier and you are trying to write the report now for the Vice President so he won't get caught with his britches down as it relates to some issue. But it seems that if a report on these recommendations is not yet complete—and you just told me it isn't—then perhaps the President was a bit premature in accepting the recommendations of the task force. Don't you think it would have been wiser for the President to have had adequate time to review a report before deciding on the merits of its recommendations?

Mr. WAMPLER. Well, the President had been very thoroughly briefed about the ingredients of the report of the Task Force, and I think you have to look at it in context. The action that the Regulatory Relief Task force recommended was not all that voluminous. We are looking at some specific FERC incentives.

Senator FORD. But it has taken you 6 months to put the report together after they gave the recommendations. It may become voluminous.

Mr. WAMPLER. Well, Mr. Chairman, the part of our report that we are putting together on Clean Coal Technology that does indicate the findings of the Task Force on Regulatory Relief is not one that has had any difficulty going through interagency concurrence. We are looking at some of the other parts of the report trying to produce as good a report as we can. So, those issues are not in contention anymore.

Senator FORD. Have any actions been taken to implement the recommendations other than your trying to prepare a report so you know what to do about clean coal technologies?

Mr. WAMPLER. We have done several things. One is that, on the FERC incentives the Department of Energy has the responsibility to prepare a rulemaking for FERC to act on. We are in the process of preparing those rule-makings, and we expect to get that to FERC by mid-summer, with some FERC action, we hope, on those incentives by November.

Also, on the State preference issue that you know resulted in some controversy, we have formed a subcommittee of ICTAP, the Secretary's advisory committee, that is going to be made up of State regulators and non-regulated utilities, government and private sector, to look at the whole issue of how we can encourage States to give preferential treatment to these technologies. So, those two things have happened.

We also internally have asked the Environmental Protection Agency to give us a plan on how they plan to implement their parts of the incentives.

So, we are moving right ahead, and I think we are making make good progress on these things. There has not been any change at all in what was contained in the recommendations of the Task Force, I might point out, since the January 23rd announcement.

Senator FORD. Well, since you are moving so rapidly with all of these recommendations, can we have a copy of the report you used to brief the President? Could we have that part of it?

Mr. WAMPLER. I don't have that, but I would be glad to give you the copy of the report that will go out to the public. That we have in draft form right now. We certainly can supply that to you.

Senator FORD. And no one has their little hot hands on what the President was briefed?

Mr. WAMPLER. Well, no. This is essentially what the President was given in briefing form. It has all the ingredients in it. It is probably just in a different format than was used in the Domestic Policy Council, I would imagine.

Senator FORD. I would be more than pleased to have it, Mr. Secretary, as soon as possible.

Mr. WAMPLER. I would certainly be able to do that.

[The information follows:]

TASK FORCE ON REGULATORY RELIEF REPORT

The Department has prepared a report on Clean Coal Technology that includes the findings of the President's Task Force on Regulatory Relief. The report is currently undergoing review within the Administration. Fossil Energy has extracted relevant portions of the document in an attachment provided to prospective Clean Coal Technology Project Proposers as part of a set of Solicitation Questions and Answers and is providing that information to the Committee.

Department of Energy
Washington, DC 20585

MAY 13 1988

Program Opportunity Notice For
Innovative Clean Coal Technology
Demonstration Projects

PON Number DE-PS01-88FE61530

Prospective Offerors:

The enclosed questions and answers are those that have been received between April 29, 1988 and May 6, 1988, that have not been previously answered.

Clarification of the terms of the PON are provided in the questions and answers enclosed in this package as well as those issued April 21, and 29, 1988. Neither these questions and answers nor any written or oral communications that occurred at the preproposal conference or in any other forum modify or supercede the terms of the PON.

Also enclosed as an attachment are three recommendations of The Task Force on Regulatory Relief on ways to promote the development and deployment of innovative control technologies. The initiatives discussed in the attachment may be made available to projects proposed under the Innovative Clean Coal Technology PON. The Department has the authority to propose rulemakings to the Federal Energy Regulatory Commission (FERC) for these technologies. It is expected that the proposed rule will be published in the Federal Register by mid-summer 1988. FERC will then be responsible for completing the action by issuance of the final rule. In addition, there are activities with the Environmental Protection Agency that may require rulemaking before they may be used.

Prospective offerors are reminded of the following:

1. In accordance with Section 3.37 of the PON (Explanation to Prospective offerors), the deadline for questions was May 6, 1988.

2. The deadline for receipt of proposals is May 23, 1988, at the time and place designated in Section 3.5 of the PON.

Sincerely,

Marcia L. Morris

Marcia L. Morris
Deputy Director
Office of Procurement Operations

137. Question

We are in receipt of Amendment 001; however, we have already completed many of the tables and calculations required to be responsive to the PON, it will require extra time and effort to make additional changes now. I suggest an extension of the due date be granted.

Answer

The issuance and closing dates for the Program Opportunity Notice (PON) are set forth by Public Law No. 100-202 (See Appendix A, "Congressional Guidance" Section of the PON).

138. Question

Your qualification criteria say that coal must be used. Do we qualify by utilizing refuse derived fuel (Processes from municipal solid waste) as an additive to bituminous Coal?

Answer

Yes

139. Question

A joint venture comprised of our firm (an American Company) and a wholly-owned American Subsidiary of a Japanese firm is preparing a proposal under the Innovative Clean Coal PON. We understand that Section 109 of the FY 1988 continuing resolution, PL 100-202, contains the Brooks-Murkowski Amendment restricting Japanese firms from bidding on construction of public works or public buildings in the United States. We need to know if this restriction is applicable to our joint venture proposal.

Answer

We do not foresee that this provision will be applicable to projects selected under the Innovative Clean Coal Technology Program.

Attachment

Task Force Recommendations to Promote Innovative Emissions Control Technology

The President asked the Task Force on Regulatory Relief to examine incentives and disincentives to the deployment of new emissions control technologies and other cost-effective, innovative NO_x and SO_2 emission reduction measures. On January 23, 1988, the White House announced acceptance of the following Task Force recommendations:

Department of Energy (DOE) Programs:

- Consider Giving Preference to Innovative Projects in States that Provide Incentives - consider giving preference, under the Administration's Clean Coal Technology (CCT) program and/or FERC regulatory incentives, to projects in States that, for rate making purposes, treat CCTs the same as pollution control projects.

- Cost-effectiveness Factors - consider giving preference in selection under the CCT program to projects demonstrating innovative technologies that promise superior cost-effectiveness.

Environmental Protection Agency (EPA) Actions:

- "New-new" Bubbles - encourage greater use of the recently promulgated policy of allowing emissions trading between two sources subject to certain New Source Performance Standards (NSPS).

- Complementary Use of New-new Bubbles and Innovative Technology Waivers - encourage use of these existing emission trading options by utilities that are uncertain whether an innovative CCT will actually achieve NSPS levels before a waiver expires.

- Commercial Demonstration Permits - expand the availability and applicability of the present commercial demonstration permits that allow innovative control technologies for utility boilers to meet less stringent standards than required for other new sources.

- NO_x Control Strategies for Ozone - issue guidance encouraging those areas of the country that can reduce ozone by controlling NO_x to examine the potential role of nitrogen oxides (NO_x) reductions in place of more expensive volatile

organic compound (VOC) reductions in State Implementation Plans (either through interpollutant emission trades or direct State regulatory actions).

Federal Energy Regulatory Commission (FERC) Actions:

- Incentive Rate of Return - establish an incentive rate of return for innovative emission control technologies (coal and non-coal) that recognizes their inherent risk. FERC already provides this incentive in certain circumstances.

- Allowance for Construction Work in Progress ("Full CWIP") - include construction costs for innovative emission control technologies in the rate base as incurred. Full CWIP is currently provided for pollution control costs and should reduce "rate shock" for consumers.

- Accelerated Amortization - apply a 20 to 20 year amortization period to recover the capital costs of innovative emission control technologies. Currently, the typical amortization period is 30 years.

One of the objectives of the FERC program is to lower costs to ratepayers while fostering technological improvements. With this objective in mind, the Task Force recommends that FERC establish a demonstration program subject to the following conditions: (1) the program will be established on a temporary basis with a possible extension beyond its initial 5-year life (after evaluating the merits of the program); (2) the program will cover no more than four units in each tehnology class; and (3) the new technology classes covered by the program should be reasonably likely to realize cost reductions of at least 15 percent when deployed.

Senator FORD. If you can get it to the committee, I would be most appreciative.

Now, you touched on this just a little bit. In the draft notices for solicitations for the second round of clean coal projects, you included a criterion to give preference to projects located in states which treat clean coal technologies the same as pollution control technologies. Yet, in the final request for proposals, as I understand it not being a lawyer, and trying to read it as a layman maybe, this criterion is only to be used as a tie-breaker. Especially in light of the recommendation of the Task Force on Regulatory Relief, why this?

Mr. WAMPLER. Well, as we looked at this issue and as there were many objections raised to this being a possible infringement of States' rights—and we are very sensitive to that—we felt that it would be best to look at the issue from the standpoint of using this criterion as a tie-breaker, in case two projects scored the same in competition.

Secondly, as I mentioned before, we have asked the ICTAP advisory panel to take a good, hard look at how we might best implement this preference. And I think we are doing it in a very responsible way. I think that this is a controversial issue. And I think we have all the parties that can take issue on this and the parties that support it now, and we will be sitting down together to try to work out the best way that we can handle this.

Senator FORD. I want to skip now to TVA just a little bit if I may, and you can flip through your big book there and find the answers to my questions. [Laughter.]

How many people prepared that book for you?

Mr. WAMPLER. Several, Mr. Chairman.

Senator FORD. The ones that were not working on the report for the Vice President. [Laughter.]

We don't lose our good humor, do we, Allen? We're not going to do that.

There was a September 1987 decision by the Comptroller General that disallowed the use of TVA power revenues for participation in Federal cost-sharing programs. Does this affect TVA's fluidized bed project at the Shawnee plant in Paducah?

Mr. WAMPLER. Mr. Chairman, it certainly does not. Not the Shawnee project.

Senator FORD. Yes.

Mr. WAMPLER. No, that does not affect the Shawnee project.

Senator FORD. That is all you need to say. You don't have to elaborate. As long as it doesn't affect the Shawnee plant in Paducah, Kentucky, that's all I need to know.

Can you clarify the status of the TVA once-through methanol plant in Muscle Shoals, Alabama? Is that project still under consideration for cost-sharing, or has that project been taken off the list?

Mr. WAMPLER. That has been taken off the list. We had no recourse but to state to TVA that their position was contrary to the Comptroller General's position. If it remains, this does affect both that project on the B list and any future proposals that they might have that makes use of power funds to finance the project.

Senator FORD. Well, Mr. Secretary, how can we resolve this problem and make TVA eligible to participate in future programs?

Mr. WAMPLER. Well, there are two ways. One would be to work with the Comptroller General to get an opinion that is different than has been rendered in the past, or it could be corrected by legislation.

Senator FORD. I'm going to have the committee staff start looking at legislation as it relates to this particular arena because I have found that TVA, whether you like it or not, has been very helpful in new, innovative ideas and participating I guess in a major way based on a small project. At Shawnee, you are looking at $200 million or so, and I guess maybe they have $10 million in it where Kentucky has about $15 million. Duke Power has some. EPRI has some. It was over-subscribed. As I understand, the project at Shawnee is ahead of schedule under budget which is terrific in this day and age.

I would like to see them continue as a participant in the valley, if I could, in projects that would directly affect them. So, staff is going to be looking at that to see if we cannot find a way that hopefully you might be able to support the change that we offer.

In closing, I—well, excuse me. He has beautiful timing. [Laughter.]

Senator DOMENICI. Were you finished?

Senator FORD. Just one last question. And we thought we were going to get out of here in about 30 or 40 minutes.

Mr. Secretary, has anything developed that we need to know as it relates to the free trade agreement with Canada, with the acid rain agreement or work in that area? Has anything happened in the last couple of days with the Prime Minister of Canada being here as a visitor?

Mr. WAMPLER. Well, as you know, Mr. Chairman, Prime Minister Mulroney has been very open on what he would like to see in terms of an accord with the United States on acid rain. He also has been very open in his support of the Free Trade Agreement. As I understand it, his discussions are continuing with the President.

The Administration has taken the position that we are following the right course in acid rain. We have a NAPAP program that is well underway. We have a Clean Coal Technology Program that is very aggressive, very strong, and that we see no overwhelming evidence that we need to do anything other than what we are doing. The Clean Air Act, with all of its problems, has been effective in the past years. Emissions are continuing to go down. We are not on the edge of any environmental precipice, and we don't feel that we need to get involved in anything that requires reductions. We think, in fact, it would not only be very expensive, but it would be sort of devastating to our technological approach.

Senator FORD. Do you think you can hold off under the pressure of the free press as it relates to acid rain?

Mr. WAMPLER. Well, we are certainly trying. We are trying with what we feel are very technically sound, logical arguments and will continue trying.

Senator FORD. We have gone through this, and if you don't have any knowledge—there is some concern here in the free trade agreement that the Dominion, which is Canada, under their constitution I think they refer to it as the Dominion. I'm not a lawyer, so I won't emphasize that again. But it is my understanding that the

attorney general of Ontario has been very concerned about the ability of the Dominion to enter into the free trade agreement with this country and then they will not be in a position to instruct the provinces under their constitution until they have a vote of each of the provinces. I don't know whether you had any feeling as it related to that or if anybody had relayed anything to you or not.

Mr. WAMPLER. No. I don't have any particular feeling for that.

Senator FORD. Attorney General Scott of Ontario has issued some very strong language as it relates to the ability of Mulroney to sign an agreement with us. He may sign it, but he cannot control the provinces as it relates to what he says they will do under the conditions of the agreement. So, I didn't get a chance to ask the Prime Minister about that today. Did you get a chance to ask him that, Pete?

Senator DOMENICI. Yes.

Senator FORD. Good.

That's the only thing I have, and I do appreciate your courtesy and your promptness and your good humor.

Senator Domenici.

STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

Senator DOMENICI. Thank you very much, Mr. Chairman. I apologize for being late.

First, with reference to your last question, let me state that I share your concern. While I have other concerns about the treaty, I understand it is a rather historic event.

But I did ask the Prime Minister at the meeting that the majority leader called that very question. How can this treaty bind the provinces of Canada knowing full well that there are legal opinions saying that the treaty does not bind the provincial governments? They have their own subsidy arrangements. They have their own law-making areas.

And his response was, to paraphrase, that is a very difficult question, but I must say to you that we are going to find a way to enforce the agreement. If it means—and he used a very technical word. I assume he doesn't mind it being reused. There were 20 Senators there. He said we will have to override them. And there are processes whereby the provincial governments are overridden in due course, and he indicated that if this passes here and passes there parliamentary-wise, that they were just going to have to live up to a commitment to see that it is enforced.

That doesn't mean that anybody has a blue print. He mentioned a few national laws of significance that are kind of emergency measures. I don't know their law, but they had to do with great emergencies and their special powers. And he enumerated a few of those. But his bottom-line conclusion was they were going to see that it was enforced even if it meant——

Senator FORD. Overriding the provinces.

Senator DOMENICI [continuing]. The overriding of the provinces, which is a technical word, but I assume it means the national government would find a way enforce it.

While I am late, I will try to be very quick with this. I have just two questions, but I would like to make a couple of points.

Mr. Chairman, I think sometimes in the United States Congress the least attention is placed on the most important matters. I want to tell a brief story about a man whose name will remain unmentioned here today. But I was driving from one city to another in the State of New Mexico, and a very enlightened scientists said to me could I try once again to make the point of America's energy dependence by suggesting to you that we are constantly talking about how great the Japanese are. He said so what I would like to do, Senator, is suggest to you that if the Japanese had the natural resources that the United States has, not only would they set a goal—and he picked a time, 15 years from now—to be energy independent, but with the resources that America has, the Japanese would set a goal of being the leading exporter of energy in 25 years. And he said they would make it, but we won't. In fact, we grow in dependence every year, and that leads me to the trade debate.

I now have the numbers. Energy imports contribute $44.2 billion.

Senator FORD. I said $45 billion.

Senator DOMENICI. You said $45 billion?

Senator FORD. Yes. I was just trying to take 25 percent of the deficit, and I just took a round figure. So, we are very close together.

Senator DOMENICI. And to Wall Street and investors and others who pass judgment on America's state of solvency in the world, a fluctuation of the trade deficit of $10 billion, $15 billion causes panic. And $44 billion of it is energy imports.

So, I think we are missing the boat when it comes to energy as a commodity, and I will say here and now specifically that has to do in my opinion with coal. While I am generally perceived to be an oil and gas state Senator, we have plenty of coal that isn't going to be used much because of strange laws like percentage reduction laws and the like. But the Nation has a huge abundance of it, and I believe we should become the world's leader—not second, not third, the leader—in the development of technology to burn fossil fuels clean and efficiently and to convert fossil fuels to more usable products. I think it is an absolute shame that we are not moving down that path.

Now, having said that, Senators Ford, Byrd and McClure deserve a great deal of credit for getting a clean coal technology program underway. It should only be a start, however, in my opinion. It will only bridge a technology gap that we face today.

I would like to spend some time and some money expending it on and talking about our becoming the technology leader and the world's largest energy exporter in the future. And I don't think it is a pipe dream.

So, let me ask you a question. In 1985 the Energy Research Advisory Board—and I'm going to quote from them in a minute—did a report on clean coal use technology, and they said:

> The paramount needs are for new fundamental insights into the physical composition, chemical structure and behavior of coal. Current research is largely concerned with marginal improvements of known systems. Therefore, an increased and consistent program of basic science related to coal should be launched by the Department of Energy. This is a key recommendation of the panel.

Now, Mr. Secretary, was the ERAB correct in saying that one key to a better coal use is more fundamental—and I quote "fundamental"—understanding of what coal is? Could you answer that?

Mr. WAMPLER. Yes, that is correct. There is much we do not know at this time about coal, and I think that, as an example, we have a lot that we don't know about coal reactivity, product yields, coal structure, coal quality, the processing environment. And those are very basic areas. We have not had a great deal of concentration on them in the past. We do have a reasonably strong advanced research and development program, but those are areas in which a good many questions are still unanswered.

Senator DOMENICI. Well, I assume that this research concept does mean understanding how we might find cheaper ways to burn coal more cheaply. That is correct.

Mr. WAMPLER. Certainly.

Senator DOMENICI. That is one of the ideas, is it not?

Mr. WAMPLER. It certainly is.

Senator DOMENICI. Can we do research on new catalysts to convert coal to liquids and gas? Can those not really improve the probability of new uses for coal in the future?

Mr. WAMPLER. We project that you can improve the efficiency and certainly the cost of those conversion processes, yes.

Senator DOMENICI. Well, a group of seven of the national laboratories got together and proposed a basic research program to be done using their existing expertise in cooperation with universities. They do not have to be universities that close to those labs. They can be universities like Kentucky, Louisiana Tech, and Louisiana State.

Senator FORD. New Mexico.

Senator DOMENICI [continuing.] Maybe New Mexico. [Laughter.]

Senator FORD. I want to tell you I am for anything you want, Pete. The way you are talking, you are doing very well. [Laughter.]

Senator DOMENICI. Well, I'm telling you we're on the right track.

Are you familiar with that proposal?

Mr. WAMPLER. Yes, I am, Senator. I have seen the proposal.

Senator DOMENICI. Well, I've tried to get seed money in this year's appropriation, but the House wouldn't take it. I believe that they were fearful that this new effort would hurt the energy technology centers that exist in this country. We know where they are, and they are tremendous facilities: Pittsburgh and Morgantown.

Do you believe that an effort like this will necessarily hurt these centers?

Mr. WAMPLER. No, Senator. I don't think it would be harmful. With your permission, I would say a few things about the national labs, as they relate to coal science. We do have a program going with several labs in coal science.

We find that we are looking at first-class staffs. We are looking at people who have very broad skills in chemical materials and engineering sciences. We find they have extensive experience in coal research that exists there already. Their instrumentation, their diagnostic capabilities are right on the cutting edge of technology. Their computers are unsurpassed, and they have some very unique experimental facilities. We consider them to be right on the lead-

ing edge of technology. So, we would see them as being very helpful in coal science.

Senator DOMENICI. Well, frankly, I would hope that at some time, with the Chairman's permission, that you might avail yourself of some time, and if he could find some time, you might brief us and give us your thoughts on what might be useful in reestablishing and strengthening a program of this type. Frankly, I think just because we failed in our synthetic fuel effort—that was an effort to actually produce the infrastructure type of entities out there and produce some models. Maybe we bit off in the American economy more than we could chew, and then we got a precipitous drop in the price of oil, as you recall, which made everything about it and the profits of gloom about its activities more front and center.

But I think we could establish our preeminence as an energy supplier if we get on with basic science research in coal. From what the scientists have told me, we are a long way from understanding its full utility, and I don't know why we ought to sit around and wait. There is nobody really doing it. So, they can't complain about the laboratories and universities doing it. We wouldn't be interfering with anyone.

Would you do that for us at some point if the Chairman were willing?

Mr. WAMPLER. I certainly would be glad to.

I might note that we have proposed a modest effort in the FY 1989 budget that we call the University/National Lab Cooperative Program which is new for us. We consider that to be a beginning to try to attempt an experimental project. And I don't recall what the number was. I think it was $433,000. Is that correct?

Senator DOMENICI. It's $433,000.

Mr. WAMPLER. But we would certainly be glad to speak to the subcommittee about this at any time.

Senator DOMENICI. Mr. Chairman, I want to close by suggesting that I truly believe we need not do any harm to Morgantown and Pittsburgh type research facilities, but we ought to have a national initiative of basic coal research aimed at something as simple as energy preeminence. We just are losing ground.

Not only this $44.2 billion is a true statement, but that is the second year in a row that it is up precipitously, and I don't see anything on the oil and gas production side that indicates that curve is going to turn down. Our production is not going to go up that much. We hope we can hold our own.

Thank you for holding the hearing and permitting me to share some thoughts with the committee and with the members of the executive branch who are here.

Senator FORD. I'll say to my good friend it is always good to work with him. His knowledge of the field and his interest is unequalled I think. We may not win them all, but we are not going to quit. We are going to keep trying. And, Mr. Wampler, we want you to help us as best you can.

I want to just add one little note to what Senator Domenici has said. As you said, the computers are state of the art, they're the best. There are none that would surpass them in these labs. They

are on the edge of technology. And somehow we are not using what we have. That is what Senator Domenici is trying to say to us.

We were fussed at the other day—at least I was—by one of my colleagues because we were making political decisions as it relates to grants or research projects to universities other than going through the peer review group.

Well, what brought us to that stage was the fact that that peer review group became the good old boy group. And everybody seemed to find a way to get the individuals on the peer review group that would keep sending these projects back to the same universities and the same research centers. And nothing else was big enough. I drew this to them in saying that I disagreed with that. I want to give a personal report because it was what I knew.

I went to the subbasement of the engineering building of the University of Kentucky while I was governor pledging to try to do something for coal to get it out of the boom and bust and put it on some kind of stable economy. Down in one corner, we had four or five people working. They were turning coal into synthetic natural gas, you know, just back there in the corner underneath the pipes. They couldn't even stand up. And in other corner of the basement, they were turning coal into oil.

To make a long story short, Jim Fleming, who is here who has always been my brains as it relates to these sort of things, put together a piece of legislation whereby we developed a research center. And I went to the basement and sat underneath all those pipes down there and signed that piece of legislation into law. There were two reasons. One, I wanted to show we had the ability to do it and the minds to discover new things. And it was a PR gimmick where they take my picture and other people would understand what we were trying to do and what was available. We put $7 million into a lab. That was just the initial investment.

We think we have a pretty good lab as it relates to research. We are trying to do our part, and in some places we spend more money in the fields of research than we get out of the Federal Government. We do that on a state basis, and we would like to get all we can get up here. As I said earlier, the only disappointment about mentioning Kentucky is you didn't mention it enough.

But the point I'm trying to make—and not to paint me as any sort of great fellow, but there are a lot of people out there that have good ideas, and most of the ideas we have today come out of people's garages. We need to reach down and give those people some help. I think that is what Senator Domenici is saying. We have got it and we are just not using it. Other people don't have it, and they get more out of what they don't have than what we do out of what we have sometimes.

We find ourselves here visiting with scientists, visiting with people who have new ideas, people that want to break new ground. And we want to give them a chance. But I have been here almost 14 years now, and I've never seen a white elephant built yet, you know, let alone a good project. You say, oh, the ground is breaking. We're moving on and that sort of thing. But I haven't even seen a white elephant finished yet. That means we have made a mistake. At least we completed a project and it was a mistake. In this country—it is kind of strange—we have the right to go broke. And

somewhere along the way I just think we have to take Senator Domenici's idea and begin to take advantage of what we have.

Senator DOMENICI. Mr. Chairman, I just want to say I have never been more certain of anything in my life than the following statement. There will be more scientific breakthroughs that occur in the next 25 years than all of civilization that preceded it. And that is because science is going to now match up with computers. Science had to move very slowly. But now you move the science of mankind with the computer, and we haven't seen anything yet. I mean, superconductivity is just one.

Now, Mr. Chairman, if you and I were to put a quiz out, what agency or entity in the free world controls the most scientists, probably we would get only two or three people who are very well informed out of an audience that would give the right answer because they would be looking around for the National Institutes of Health. They would look around and say maybe it's the Department of Defense.

Do you know who it is? You. The Department of Energy has 23,000 scientists in its nine national laboratories, and I use the word "control." They actually literally control nine laboratories with 23,000 scientists. That is the largest array of talent in one institution in a generation where we are moving scientifically that there is around. And sooner or later we have to get a commitment. If we can't legislate it, we're going to have to talk a President into issuing an executive order that the Department of Energy's labs ought to be involved in helping to solve America's economic problems. This one is within their purview.

If we could get a fundamental science of coal program going, laboratories to universities, we don't need an executive order. That is science. But I tell you they could help all over the place, but we are not committed to it. And I'm not blaming you. You can't do more than the law says and the executive permits. But that is a truism.

Thank you very much.

Senator FORD. Thank you, Senator, and thank you, gentlemen.

[Whereupon, at 2:32 p.m., the hearing was adjourned.]

APPENDIX

RESPONSES TO ADDITIONAL QUESTIONS

J. BENNETT JOHNSTON, LOUISIANA, CHAIRMAN
DALE BUMPERS, ARKANSAS
WENDELL H. FORD, KENTUCKY
HOWARD M. METZENBAUM, OHIO
JOHN MELCHER, MONTANA
BILL BRADLEY, NEW JERSEY
JEFF BINGAMAN, NEW MEXICO
TIMOTHY E. WIRTH, COLORADO
WYCHE FOWLER, JR., GEORGIA
KENT CONRAD, NORTH DAKOTA
JAMES A. McCLURE, IDAHO
MARK O. HATFIELD, OREGON
LOWELL P. WEICKER, JR., CONNECTICUT
PETE V. DOMENICI, NEW MEXICO
MALCOLM WALLOP, WYOMING
FRANK H. MURKOWSKI, ALASKA
DON NICKLES, OKLAHOMA
CHIC HECHT, NEVADA
DANIEL J. EVANS, WASHINGTON
DARYL H. OWEN, STAFF DIRECTOR
D. MICHAEL HARVEY, CHIEF COUNSEL
FRANK M. CUSHING, STAFF DIRECTOR FOR THE MINORITY
GARY G. ELLSWORTH, CHIEF COUNSEL FOR THE MINORITY

United States Senate
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, DC 20510-6150

May 3, 1988

The Honorable J. Allen Wampler
Assistant Secretary
Fossil Energy Programs
U. S. Department of Energy
Washington, D.C. 20510

Dear Mr. Wampler:

I want to thank you for testifying before the Subcommittee on Energy Research and Development on April 28, 1988 on the Department's FY89 budget request for fossil energy and clean coal programs. As a follow-up to the hearing, I am enclosing several questions to be answered and included in the printed hearing record. I would like to receive the answers to these questions as soon as possible, but not later than May 27, 1988.

In addition to sending your responses to myself and my colleagues, please provide a copy of your written responses to Mr. Al Astrin of the full committee staff in room SD-304. If you have any questions concerning this request please contact Cheryl Moss at 224-7569.

Sincerely,

Wendell Ford

Wendell H. Ford
Chairman, Subcommittee on
Energy Research and Development

Enclosures

WF/tc

SENATOR DALE BUMPERS
QUESTIONS FOR ASSISTANT SECRETARY ALLEN WAMPLER
HEARING ON FOSSIL ENERGY AND CLEAN COAL BUDGET
APRIL 28, 1988

1. MR. WAMPLER, last November, this Committee held an interesting set of oversight hearings on the "Greenhouse Effect and Global Climate Change". Are you aware that the greenhouse gases already in the atmosphere have committed the earth to a 2 - 5 degree Farenheit warming?(this would occur in 2 to 4 decades)

Are you aware that global emissions of carbon dioxide have risen to an all time high? And that the major source of CO2 is the burning of fossil fuels?

Why then, in your budget justification section entitled "Principal Issues in Fossil Energy between now and 2000", is there no mention of the greenhouse effect?

2. Has the fossil energy office ever done an analysis of what its research and development priorities ought to be in light of the greenhouse effect? Have you ever prepared a set of options for R & D investments for the future of your program in the context of the greenhouse effect?

3. I recognize that you may view your mission as promoting the use of fossil fuels, and that energy policy which takes the greenhouse effect into account might be more appropriately developed by the Secretary of Energy.
Is there any policy coordination at the Secretarial level on this issue?
Is the greenhouse effect integrated into DOE's planning at this level?
Have you ever discussed the greenhouse effect at a management meeting at the Department?

4. I understand that the Asst. Secretary for Environment has a small amount of funding available to study the greenhouse effect. Do you receive any policy input from that office?

5. DOE'S Office of Energy Research has a division of Carbon Dioxide Research. In fact DOE is the lead agency for CO 2 research. Does your office receive data or policy recommendations from that research effort? Do you meet with the researchers working on carbon dioxide issues?

6. Carbon dioxide (CO 2) is a by-product of coal. Nitrous Oxide (N 2 O) is a by-product of coal. Both are greenhouse gases. CO and NOx are indirect greenhouse gases produced by coal.

Does your program analyze the impact of the various fossil technologies on these greenhouse gases?
Are you prepared to examine the impact of the various technologies under your jurisdiction on the greenhouse effect?

7. I understand that coal produces about twice the CO2 per BTU as does natural gas. Yet you intend to spend $101 million on coal research and about $1 million on gas? Why?

8. You also have a massive effort underway to demonstrate Clean Coal Technologies - with over $500 million in advance appropriations for FY 89.

What in your mind is the definition of clean coal?

I understand that this effort is directed towards the acid rain problem. Will this huge program have any impact on reducing emissions of greenhouse gases? Or will it actually increase the emissions of greenhouse gases by stimulating coal use rather than conservation ?

QUESTIONS FROM MINORITY MEMBERS
DOE FY89 FOSSIL BUDGET HEARING
APRIL 28, 1988

QUESTIONS FOR DOE ASSISTANT SECRETARY J. ALLEN WAMPLER

QUESTIONS FROM SENATOR JAMES A. McCLURE.

1. The opening line of the Assistant Secretary's prepared testimony supports a "sound coal research and development program" yet once again the Administration proposes major reductions in these vary programs compared to fiscal year 1988.

   a. For each program area, what will be the effect of these reductions on long-term, high-risk research and development capabilities?

   b. For each program area, what will be the attendant reductions in Federal and contractor personnel?

2. The opening line of the Assistant Secretary's prepared testimony also supports a "new emphasis on the enhanced recovery of oil; however, level funding is proposed between fiscal years 1988 and 1989. What is the basis for characterizing this proposal as "new emphasis"?

3. The opening line of the Assistant Secretary's prepared testimony also emphasizes initiation of a two-phase cooperative R&D venture program in fossil energy.

   a. How would this program be structured?

   b. What is the specific statutory authority for this program? Will legislation be sought from the Congress?

4. How does the Administration's proposed FY89 fossil energy budget compare to the program that the Gas Research Institute has indicated that it is prepared to support?

5. We are all aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation.

   a. What is the status of the Cool-Water Coal Gasification Program? For example, when will the SFC support terminate? What will happen at that time?

   b. What support does the Cool-Water project receive either directly or indirectly from the Department of Energy?

   c. Does the Department consider the continued operation of the

Cool-Water facility as important to achievement of the objectives of the clean coal technology program?

d. What are the plans of the present sponsors for continued operation? If they are not prepared to continue operation of the facility, why not?

e. As the DOE clean coal program is presently constituted would the Cool-Water project be eligible to seek support from DOE?

6. a. How does your FY89 budget request for fuel cell research compare to the level of funding that the Gas Research Institute and EPRI has indicated that it is prepared to support?

b. In answers for the record from the March 1 budget hearing the Department indicates that several fuel cell products could well be on the market within 5 to 10 years. When is it expected that Japanese or European manufacturers will offer for sale a commercially available fuel cell for either electric power or transportation uses?

c. What support is being provided by the Japanese or European governments to stimulate the commercial development of this technology?

7. Recently the Committee reported coal slurry legislation (S. 801). That legislation contained a provision modifying section 2(c) of the Mineral Leasing Act to permit railroads or their affiliates, with certain stringent limitations, to obtain Federal coal leases in their land grant areas. What is your opinion of the effect of that amendment?

QUESTIONS FOR ASSISTANT SECRETARY J. ALLEN WAMPLER
U.S. DEPARTMENT OF ENERGY
SENATOR LOWELL WEICKER, JR.
APRIL 28, 1988

1) Mr. Wampler, I am disturbed by the President's budget request for funding of the fuel cell programs. Earlier questions to Secretary Herrington drew an unsatisfactory response. Mr. Wampler, is our nation the leader in the development of fuel cell technology? How much more money will the Japanese devote to fuel cell research versus the President's FY89 request?

2) Mr. Wampler, Secretary Herrington earlier stated that "Japan is at least several years behind the U.S. in the development of the phosphoric acid fuel cell (PAFC) power plant." However, I have just learned that Fuji Electric Company of Japan is presently marketing a 200KW PAFC in the United States. In your opinion, is this fact consistent with the Secretary's earlier statement? Do you feel that the Japanese are serious competitors in the fuel cell market?

3) Mr. Wampler, will the President's FY89 budget proposal for the Molten Carbonate Fuel Cell (MCFC) program allow for another solicitation to be made to develop a full scale molten carbonate stack in 1989? Do you see any need for additional funds in FY90 to advance the contractors to the point of being able to successfully respond to a new PRDA?

Department of Energy
Washington, DC 20585

June 8, 1988

Honorable Wendell H. Ford
Chairman
Subcommittee on Energy Research
and Development
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

On April 28, 1988, J. Allen Wampler, Assistant Secretary for Fossil Energy appeared before your subcommittee to discuss the Department's Fiscal Year 1989 budget authorization for Fossil Energy.

Following that hearing, you submitted written questions, on behalf of Senator Bumpers, Senator McClure and Senator Weicker for our response to supplement the record. Enclosed are the answers to those questions, which have also been sent to Senator Bumpers, Senator McClure and Senator Weicker.

If you have any questions, please have your staff call Michael Gilmore on 586-4277. He will be happy to assist.

Sincerely,

for Rebecca A. Thompson
Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosure

CCT-1

QUESTION: Are you aware that the greenhouse gases already in the atmosphere have committed the earth to a 2 - 5 degree Fahrenheit warming? (This would occur in 2 to 4 decades.)

Are you aware that global emissions of carbon dioxide have risen to an all time high? And that the major source of CO_2 is the burning of fossil fuels?

Why then, in your budget justification section entitled "Principal Issues in Fossil Energy between now and 2000" is there no mention of the greenhouse effect?

ANSWER: We are aware that the consensus of scientific opinion is that greenhouse gases present in the atmosphere contribute to global warming. We are also aware that concentrations of CO_2 have been steadily increasing as have other greenhouse gases. There are many uncertainties regarding historical emissions of CO_2. While the major source of CO_2 concentration is the burning of fossil fuels, it is important to note that there are other sources as described in the following table. This table also lists important emission sources fcr other greenhouse gases.

The basic research on the causes and effects of CO_2 in the global environment is the lead responsibility of the Office of Energy Research (OER) and thus is covered in the ER program. The more the world uses recoverable and non-combustion energy sources and conserves energy, the less the emissions of CO_2. However, it is recognized that without major changes to the world-wide energy infrastructure, fossil fuels will be combusted for a long time, thus producing large quantities of CO_2.

Nonetheless, a logical approach to the reduction of CO_2 from fossil fuel sources is to improve the energy-consuming machinery so that greenhouse-gas emissions can be held to a minimum level. This is an inherent element in all of the Department's FE R&D, although it was not explicitly stated in the justification section of Fossil Energy's FY 1989 budget. Additionally, FE is currently reviewing its programs to determine the feasibility of an initiative specially aimed at the control or utilization of CO_2 from the fossil-fuel combustion process, to be included in our FY 1990 budget request.

SOURCES OF EMISSIONS OF KEY RADIATIVELY IMPORTANT GASES
(Teragrams/year and percent[b])

Gas	Natural Origin	Man-Made Agriculture	Man-Made Manufacture	Man-Made Energy
CO_2	200,000	1,500 (23%)	120 (2%)	5,00 (75%)
CH_4	197 (40%)	170 (35%)	30 (6%)	95 (19%)
CO	595 (54%)	270 (24%)	40 (4%)	200 (18%)
N_2O	25 (78%)	2.7 (8%)	0 (0%)	4.4 (14%)
NOx	9 (22%)	6 (15%)	0 (0%)	26 (63%)
$CFCl_3$	0 (0%)	0 (0%)	.26 (80%)	.07 (20%)
CF_2Cl_2	0 (0%)	0 (0%)	.42 (95%)	.02 (5%)

NOTES:

[a] Natural processes include such things as plant emissions, oceans, wetlands, soils, etc. Man-made, Agriculture includes land-use change, as well as agricultural practices such as fertilization, savanna burning, cattle raising, and rice growing. Man-made, Manufacturing includes non-energy and non-agricultural activities such as chemical and cement manufacture, and solid waste landfills. Man-made, Energy includes the production, transformation and end-use of traditional and modern energy products as well as the use of CFC's used in the production of insulation.

[b] Percents are those of total emissions by gas except for CO_2, whose totals include only man-made emissions. For each gas percentages add to 100% except for differences due to independent rounding.

CCT-2

QUESTION: Has the Fossil Energy Office ever done an analysis of what its research and development priorities ought to be in light of the greenhouse effect? Have you ever prepared a set of options for R&D investments for the future of your program in the context of the greenhouse effect?

ANSWER: The analyses of the Fossil Energy R&D priorities are not specifically targeted toward the greenhouse effect; however, the overall environmental issues related to the use of fossil fuels is a significant factor in the R&D planning and analysis process. To date we have not prepared R&D options specifically oriented toward or addressing the greenhouse effect; however, such R&D options would first include the more efficient energy-producing technologies, such as fuel cell/gasification combined cycle, integrated gasification combined cycle (IGCC), and pressurized fluidized bed (PFB) combustion, which are major development elements of the present FE programs. Research initiatives for the control of CO_2 from fossil-fueled facilities are presently being identified.

CCT-3

QUESTION: I recognize that you may view your mission as promoting the use of fossil fuels, and that energy policy which takes the greenhouse effect into account might be more appropriately developed by the Secretary of Energy? Is there any policy coordination at the Secretarial level on this issue?

ANSWER: The greenhouse gases/global climate change issue is coordinated in the Department by the Assistant Secretary for Environment, Safety and Health (ASEH). Policy activities are coordinated with the other major offices in the Department by the ASEH. Information and decision memoranda and briefings are initiated by ASEH for the Secretary, the Deputy Secretary and the Under Secretary. Additionally, the EH office participates in interagency staff meetings and initiates information briefings for staff of other offices. Recent coordination on this topic by EH includes provision of information to staff members of the Offices of Policy, Planning and Analysis, International Affairs and Energy Emergencies, Energy Research, Conservation and Renewable Energy, Nuclear Energy, and Fossil Energy.

QUESTION: Is the greenhouse effect integrated into DOE's planning at this level?

ANSWER: The planning of Department programs reflects the need to conduct research on greenhouse gases/global climate effects and to develop and coordinate policy response capabilities. These activities are led by the Office of Energy Research (OER), and Environment Safety and Health respectively. Further, many DOE energy programs include consideration of the issue, even when it is not the motivating element for or the focal point of the program. Examples of this are the recent initiation by the Office of Conservation and Renewable Energy of a Task Force to consider the impacts of the traditionally-used chlorofluorocarbons in conservation materials on depletion of the ozone layer; and the Office of Energy Research's collection of carbon dioxide (CO_2) emission rate data for fossil fuel combustion and the reporting of CO_2 and other greenhouse gases trends that are implied in energy-use projections developed to support the National Energy Policy Plan (NEPP). The CO_2 projections have been included in the environmental appendix of NEPP since 1979, and the Department has been responsible for increased consideration of potential greenhouse gases impacts in international studies conducted by the Organization for Economic Cooperation and Development and the International Energy Agency, as well as relevant United Nations organizations.

QUESTION: Have you ever discussed the greenhouse effect at a management meeting at the Department?

ANSWER: As noted above, the topic of the greenhouse effects has been included in management and planning meetings, has been coordinated at the Secretarial level, and involves seven different offices.

CCT-4

QUESTION: I understand that the Assistant Secretary for Environment has a small amount of funding available to study the greenhouse effect. Do you receive any policy input from that office?

ANSWER: The Assistant Secretary for Environment, Safety and Health ha. the responsibility to coordinate policy related activities on this issue within the Department (as noted in the response to question 3a). I have, and my staff has, received policy input from that office, directly and through Secretarial officers. Additionally, that office has solicited information and views from myself and my staff in their development of policy positions and options for Departmental decision making.

CCT-5

QUESTION: DOE's Office of Energy Research has a division of Carbon Dioxide Research. In fact, DOE is the lead agency for CO_2 research. Does your office receive data or policy recommendations from that research effort? Do you meet with the researchers working on carbon dioxide issues?

ANSWER: The research results and related data and insights developed by the Carbon Dioxide Research Division (CDRD) of the Office of Energy Research are routinely available to personnel in the Office of Fossil Energy by distribution of reports, by information briefings and by responses to specific requests. Additionally, these results form an important basis of assessments and policy options analysis carried out by the Office of Environment, Safety and Health that are coordinated with my office. Finally, the results of the CDRD and other units in the Office of Energy Research form a basis for the research findings reported by the Director of Energy Research in Secretarial level management and program planning meetings.

CCT-6

QUESTION: Carbon dioxide (CO_2) is a by-product of coal. Nitrous Oxide (N 2 O) is a by-product of coal. Both are greenhouse gases. CO and NO_x are indirect greenhouse gases produced by coal. Does your program analyze the impact of the various fossil technologies on these greenhouse gases? Are you prepared to examine the impact of the various technologies under your jurisdiction on the greenhouse effect?

ANSWER: Yes. Included in every coal technology R&D project FE conducts is detailed environmental analysis and monitoring of a wide range of pollutants including, in most cases, CO_2 and NO_x.

If directed, we could conduct an assessment of the impact of potential releases of CO, NO_x, and CO_2 related to the various coal technologies under development in DOE's coal program. However, we believe the environmental analyses performed as part of the R&D program planning process already examine such environmental concerns.

CCT-7

QUESTION: I understand that coal produces about twice the CO_2 per Btu as does natural gas. Yet you intend to spend $101 million on coal research and about $1 million on gas? Why?

ANSWER: The proper research and development goal is aimed at making available to U.S. industry a mix of energy resources that will enhance national security while protecting the environment to the maximum extent possible. Coal is, by far, our most plentiful and readily available resource; its supply is not susceptible to disruption caused by actions of foreign powers, beyond our control. Therefore, we believe that, from an overall viewpoint of fossil fuel combustion products, such as CO_2, and by-product pollutant emissions, such as NO_x, the larger R&D expenditures on coal technologies are warranted, when compared to the expenditures in the more-finite resource, natural gas.

CCT-8

QUESTION: You also have a massive effort underway to demonstrate Clean Coal Technologies -- with over $500 million in advance appropriations for FY 89.

What in your mind is the definition of clean coal?

I understand that this effort is directed towards the acid rain problem. Will this huge program have any impact on reducing emissions of greenhouse gases? Or will it actually increase the emissions of greenhouse gases by stimulating coal use rather than conservation?

ANSWER: Clean coal technologies are those that improve the technical (including efficiency), economic and environmental performance of using coal in a variety of market sectors. For the purpose of the ICCT program, it is limited to technologies which can be cost-effectively used to retrofit or repower existing and often much less efficient (in terms of amounts of coal used) facilities.

Thus, wide-spread clean coal technologies deployment across this universe of candidate facilities could provide near-term international reductions in CO_2 due to the improved energy efficiency of some of the technologies and consequently, reductions in the amounts of coal used to produce the same amount of energy. Many of these promising technologies use 20-30 percent less fuel than conventional coal-burning facilities.

FUNDING REDUCTIONS FOR FOSSIL ENERGY R&D
Question 1A

QUESTION: The opening line of the Assistant Secretary's prepared testimony supports a "sound coal research and development program" yet once again the Administration proposes major reductions in these very programs compared to fiscal year 1988. For each program area, what will be the effect of these reductions on long-term, high-risk research and development capabilities?

ANSWER: The FY 1989 budget request is consistent with the Administration's efforts to reduce the Federal deficit by focusing federal funds only on those efforts that are of highest priority and affordable. We have arrived at a budget recommendation that strengthens those areas that needed strengthening and deemphasizes those areas where goals have been achieved and targets met. Given current fiscal constraints, we believe the FY 1989 budget request for Fossil Energy R&D is both technically defensible and fiscally responsible.

The following shows the significant reductions within Fossil Energy R&D:

Coal -- $-132.223 million (FY 1988 $233.768 million; FY 1989 $101.545 million)
Approximately one-half of the proposed reduction ($62.3 million) can be attributed to the phase-out of four projects that have achieved their objectives -- the Wilsonville and LaPorte liquefaction facilities, the Waltz Mill gasification facility, and the phosphoric acid fuel

cell program -- and our recommendation to cease funding for the MHD program because the cost is not affordable in light of current fiscal constraints. The majority of the remaining decrease is due to: (1) projects such as the Gravimelt integrated system, Grimethorpe, LIMB, and METC fixed-bed gasification reactor that are coming to a conclusion in FY 1988 and, therefore, are not in the FY 1989 request; and (2) Congressional add-ons that will not be continued or have been reduced such as UNDEMRC, coal preparation activities at SIU and Ames, molten carbonate fuel cell contracts (IFC, ERC, IGT), heat engines contracts reduced from four to two in gas turbines and two to one in diesels, mild gasification, GE gasifier, etc.

Petroleum -- $-9.278 million (FY 1988 $29.464 million; FY 1989 $20.186 million)

The major reduction is for oil shale ($8.5 million). The Department will complete FY 1988 activities directed by Congress and continue only in-house activities. Oil shale activities have been postponed since they are not likely to become economically viable for a number of years. We believe funds can be better used in areas that can help our liquids supply problem earlier -- such as Enhanced Oil Recovery (EOR). The FY 1989 budget request concentrates petroleum research efforts toward heavy and light oil research, both nearer-term technologies when compared to oil shale.

Unconventional Gas Recovery (UGR) -- $-8.8 million (FY 1988 $10.534 million; FY 1989 $1.734 million)

The major reductions in this program are due to: (1) the completion in FY 1988 of testing at the multiwell experiment (MWX) facility and the horizontal well test; and (2) Congressional add-ons for secondary gas recovery, oil and gas technology transfer seminars, and geosciences and EOR research efforts. In-house research in model applications and systems analysis will continue. A substantial amount of data has been accumulated in three major projects -- multiwell test, horizontal test, and offset well test. Given the success of these projects, and the data they have produced, we believe FY 1989 is a good year to spend compiling and analyzing this data and identifying future research needs. In addition, the UGR technology is viewed as a candidate for the Cooperative R&D Ventures Program.

Plant and Capital Equipment -- $-17.73 million (FY 1988 $18.23 million; FY 1989 $0.50 million)

The majority of this reduction ($15.5 million) comes from not requesting funding for the construction projects at West Virginia University, the University of Oklahoma, and METC which were Congressional add-ons for FY 1988. The Fossil Energy Program places a higher priority on research and development efforts compared to plant and capital equipment.

Program Direction -- $-27.051 million (FY 1988 $62.078 million; FY 1989 $35.027 million)

The FY 1989 budget request proposes the elimination of employment floors prescribed by law. We believe that management flexibility in matching staffing to workload is needed and, therefore, the budget request proposes the repeal of employment floors.

FUNDING REDUCTIONS FOR FOSSIL ENERGY R&D
Question 18

QUESTION: For each program area, what will be the attendant reductions in Federal and contractor personnel?

ANSWER: Attached is a table which reflects both Federal employee and contractor staff reductions based upon the FY 1989 Budget Request. If the FY 1989 Budget Request is accepted, the impact to the Fossil Energy R&D Coal program would be a reduction of full-time Federal employees of approximately 30 against a funding decrease of $132,223,000 for the Coal Program. There are no expected reductions in either the Gas or the Petroleum programs for Federal employees.

Contractor staff reductions are expected to be around 1,500 for the total Fossil Energy R&D program with a majority of the reductions to occur within the Coal Program (approximately 1,300). Approximate reductions in each of the Gas and Petroleum programs are about 100.

REDUCTIONS IN FEDERAL AND CONTRACTOR PERSONNEL
BASED UPON THE FY 1989 BUDGET REQUEST

PROGRAM	FY 1989 FEDERAL STAFF REDUCTIONS	FY 1989 CONTRACTOR REDUCTIONS
Control Technology and Coal Preparation	-1	-121
Advanced Research and Technology Development	-4	-35
Coal Liquefaction	-23	-168
Combustion Systems	-2	-77
Fuel Cells	0	-275
Heat Engines	0	-90
Underground Coal Gasification	0	-25
Magnetohydrodynamics	0	-400
Surface Coal Gasification	0	-180
Total Coal Reductions	-30	-1,371
Unconventional Gas Recovery	0	-88
Advanced Process Technology	0	-12
Enhanced Oil Recovery	0	+4
Oil Shale	0	-85
Total Petroleum Reductions	0	-93
Program Direction	-103	-35
TOTAL FE R&D REDUCTIONS	-133	-1,587

EOR INITIATIVE
Question 2

QUESTION: The opening line of the Assistant Secretary's prepared testimony also supports a "new emphasis" on the enhanced recovery of oil; however, level funding is proposed between fiscal years 1988 and 1989. What is the basis for characterizing this proposal as "new emphasis"?

ANSWER: The Department's Enhanced Oil Recovery (EOR) budget request for FY 1988 was $9.3 million. The FY 1989 request is $17.0 million, slightly higher than the $16.5 million appropriated by the Congress in FY 1988, and about double the FY 1988 request. The basis for this larger request, and for characterizing it as "new emphasis," is the recognition that there are urgent reasons for expanding the Federal role in dealing with the steady decline in domestic oil production. The expanded effort will address near-term issues in addition to the more traditional long-term questions.

There are two major studies that have led to this recommendation. The first is the report by the Energy Research Advisory Board (ERAB) on the importance of geoscience research to achieving better recovery efficiencies from oil reservoirs. The second is a Fossil Energy staff study in which senior managers of our oil program met with over 100 individuals in 24 organizations, including major oil companies, independent operators, service companies, state agencies, national laboratories, universities, and private research institutions. The

results of these two efforts have been integrated into an expanded oil research program.

The FY 1989 budget request of $17 million represents the first stage of this expanded effort wherein both the engineering and geoscience disciplines will be integrated in the evaluation of production constraints and the development of critical research to resolve them. Maintaining marginal production, such as from stripper operations, is an issue that will specifically be addressed because of its urgency. The effort will also begin dealing with the fundamental issues of uncontacted and by-passed mobile oil that can have considerable impact under prevailing economic conditions, as well as the concept of reservoir typing that can improve our ability to define work in terms of its extent of application. The agenda, in addition to the expanded geoscience and reservoir characterization work, will also include increased emphasis on technology with near term impact such as drilling technology, well completion, equipment retrofit, workover and stimulation, and technology transfer. Our more traditional EOR work on process technology, rock/fluid interaction, evaluation of novel production techniques that hold promise, and other long-term efforts will continue. New emphasis will also be placed on environmental mitigation research, reflecting increased concern with oil field operations. The analytical capabilities of the

Tertiary Oil Recovery Information System will be expanded to support the geoscience and other near-term activities.

Thus, the proposed FY 1989 program, the largest in many years, deserves the description of a "new emphasis" on the enhanced recovery of oil.

INITIATION OF A TWO-PHASE COOPERATIVE R&D VENTURE PROGRAM
Question 3A

QUESTION: The opening line of the Assistant Secretary's prepared testimony also emphasizes initiation of a two-phase cooperative R&D venture program in fossil energy. How would this program be structured?

ANSWER: Under the proposed program, the Department would join with U.S. industry and other non-federal entities in cost-shared cooperative R&D ventures focusing on precommercial stages of fossil energy technology development. Within broadly defined guidelines, the content and direction of each venture would be determined by the industrial participants, with the Department having the role of a minority funding partner. The Department's cost share would be limited to a maximum of 49 percent and the Department would share in the revenues of any ventures that are eventually financially successful. Key features of the program would be the primary role of the private sector in selecting the content and direction of the ventures and streamlining the business practices between the Department and its venture partners, assuring greater marketplace relevance, technology transfer, and cost sharing.

Implementation is proposed as a two-phased, multiyear program. The first phase, estimated to require approximately $27 million over a four year period, would give priority to ventures focusing on the development of technologies which can increase the effective domestic resource base for moderately priced liquid and gaseous

fuels; an area where potential participants have indicated a readiness to proceed. The second phase, where awards would be made one year later, would support a subsequent set of ventures to be defined and organized by potential participants during the intervening period.

INITIATION OF A TWO-PHASE COOPERATIVE R&D VENTURE PROGRAM
Question 3B

QUESTION: What is the specific statutory authority for this program? Will legislation be sought from the Congress?

ANSWER: The program would be implemented using procedures available to the Department under its enabling legislation, and no additional legislation is being sought.

FY 1989 BUDGET REQUEST VS GRI PROPOSAL
Question 4

QUESTION: How does the Administration's proposed FY 1989 Fossil Energy budget compare to the program that the Gas Research Institute has indicated that it is prepared to support?

ANSWER: As stated in a GRI news release dated March 3, 1988, and, in the Outside Witness Testimony of David O. Webb, Vice President, GRI, in his testimony before the HSS&T Subcommittee on Energy and Research Development, the proposed GRI budget for DOE is shown on the following page. Also shown is Fossil Energy's FY 1989 request for each related activity.

While the GRI recommendations place a greater emphasis on the gas research programs, the FY 1989 budget request for Fossil Energy R&D of $168 million is consistent with the Administration's efforts to reduce the Federal deficit by focusing federal funds only on those efforts that are of highest priority and that are affordable. We believe the FY 1989 budget request for Fossil Energy R&D is both technically defensible and fiscally responsible.

Gas-Related Research Recommendations
for DOE FY 1989 Fossil Energy Program
($ in Millions)

	GRI's Recommended Budget level for DOE FY 1989	GRI Planned Budget 1989	Fossil Energy Request for FY 1989
Adv. Res. (Sur. Coal Gas.)	$ 6.00	$ 11.20	$ 0.694
Fuel Cells (Gas-Related)	22.70	3.80	6.634
Coal Gasification	16.75	1.90	5.027 1/
Unconventional Natural Gas	10.00	30.40	1.734 2/
Gas-Related Geosciences	10.00	2.70	...
Gas-Enhanced Emission Control	N/A	6.50	N/A
Basic Research	N/A	5.00	N/A
Liquid Spill Test Facility	1.50	0.50	0.766
	$ 66.95	$ 62.00	$ 14.855

1/ Includes Advanced Research/Surface Coal Gasification.
2/ Part of the Unconventional Gas Recovery Program.

COOL-WATER COAL GASIFICATION PROGRAM
Question 5A

QUESTION: We are aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation. What is the status of the Cool-Water Coal Gasification Program? For example, when will the SFC support terminate? What will happen at that time?

ANSWER: Program operations were initiated in the spring of 1984 and steadily improved to where a 90 percent on-stream factor and 90 percent capacity factor were achieved during the last six months of 1987. Sponsors of the program, the U.S. Treasury and the utility industry (potential users of the technology) consider the program to have successfully demonstrated the operation of a Texaco entrained flow coal gasifier with a combined cycle power generator at a scale replicable in the utility and industrial sector. The U.S. Treasury has conducted, through the program sponsors, an environmental monitoring effort that has confirmed the technology's performance to be well within permitted limits and the monitoring effort has not identified any unexpected performance with regard to unregulated components of the emissions from the project. (As a matter of record, it should be noted that the Cool-Water project did not receive a loan guarantee from the Synthetic Fuels Corporation but rather a price guarantee.)

The SFC price supports were initiated in June 1984 and will continue until whichever occurs first:

- 20,000,000 units (unit = 1 million Btu's) of product have been sold,

- $120 million of price support have been expended, or

- five years from June 1984.

At the current rate of production and monthly price guarantee payments, the production cap will probably be achieved first, during the second quarter of 1989.

Under the terms of the price guarantee commitment with SFC, Southern California Edison (SCE), one of the program sponsors, is to acquire the facility, unless SCE determines continued operation is not economically attractive in the event there no longer exists reasonable assurances that the present value of the next fifteen years of operation will be positive. Currently, the operating cost and revenue projections made by SCE do not support a finding of the continued operation of the project to be economically reasonable. However, the U.S. Treasury projections indicate a positive net present value for the next fifteen years of operation. For this reason the Treasury Department has held SCE to the obligation of the price guarantee commitment to proceed with obtaining the necessary permits and California Energy Commission (CEC) approvals to continue operation. The CEC has reviewed the SCE and Treasury data as well as made its own analysis and has conducted a public hearing

regarding making a determination of the projects economic viability. This review is just the beginning of the CEC review process.

Treasury and SCE continue to negotiate projections of operating costs, oil prices, availability, discount rate, interest rate, etc., to use in calculating the net present value of the next fifteen years of operation.

COOL-WATER COAL GASIFICATION PROGRAM
QUESTION 5B

QUESTION: We are aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation. What support does the Cool-Water project receive directly or indirectly from the Department?

ANSWER: The Cool-Water project receives no support directly from the Department of Energy and essentially none indirectly. DOE is a member of the environmental monitoring review committee which assists in directing the monitoring activity mentioned previously. DOE/Fossil Energy is sponsoring research with Texaco that could ultimately be tested at the Cool-Water facility, if it is still operating.

COOL-WATER COAL GASIFICATION PROGRAM
Question 5C

QUESTION: We are aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation. Does the Department consider the continued operation of the Cool-Water facility as important to the achievement of the objectives of the clean coal technology program?

ANSWER: The operation of the Cool-Water facility has significantly contributed to the advancement and acceptance of the technical feasibility of integrated gasification combined cycle technology. Continued operation of the facility contributes to the experience and data that potential project sponsors under the Innovative Clean Coal Technology Program will analyze to make commercial investment decisions regarding the repowering of existing facilities or constructing new power plants.

COOL-WATER COAL GASIFICATION PROGRAM
Question 5D

QUESTION: We are aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation. What are the plans of the present sponsors for continued operation? If they are not prepared to continue operation of the facility, why not?

ANSWER: The sponsors will certainly continue operation during the price guarantee period; after that, the plans of the sponsors are uncertain. According to the Treasury Department, two of the participants interested in continuing operation, Texaco and the Electric Power Research Institue, are exploring alternatives such as submitting a proposal under the Innovative Clean Coal Technology Solicitation. As explained previously, an economic feasibility evaluation (satisfactory to Treasury) remains to be completed and a determination regarding continued operation needs to be made by SCE as defined in the obligations of SCE in the Commitment to Guarantee. SCE has indicated an unwillingness to acquire the facility and continue its operation based upon SCE's projections indicating it would not be economic.

COOL-WATER COAL GASIFICATION PROGRAM
Question 5E

QUESTION: We are aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation. As the DOE Clean Coal Program is presently constituted, would the Cool Water project be eligible to seek support from DOE?

ANSWER: The deadline for receipt of proposals under the Innovative Clean Coal Technology Solicitation is May 23, 1988. In order for a proposal to be considered for comprehensive evaluation, it must comply with the following qualification criteria.

- The proposed demonstration project or facility (existing or new) must be located in the United States.
- The proposed demonstration project must be designed for and operated with coal(s). These coals must be from United States mines.
- The offeror must agree to provide a cost share of at least 50 percent of the total project cost, with at least 50 percent in each of the three project Phases.
- The proposer must have access to, and use of, the proposed site and any proposed alternate site(s) for the duration of the project.
- The proposed project team must be identified and firmly committed to fulfilling its proposed role in the project.
- The offeror agrees that, if selected, it will submit a "Repayment Plan" consistent with Section 6.4 of this PON.

Comprehensive evaluation of a proposal will address technical, financial, environmental, commercial and management aspects of the project. As part of the requested technical information, the proposer must explain the degree to which the project represents an application currently being demonstrated. If some duplication or replication of a previous demonstration is planned, the proposer is to provide a justification and explanation.

A proposal, if submitted by the deadline, which satisfies the qualification criteria listed and passes preliminary review, would then be comprehensively evaluated.

Fuel Cells
Question 6A

QUESTION: How does your FY89 budget request for fuel cell research compare to the level of funding that the Gas Research Institute and EPRI has indicated that it is prepared to support:

ANSWER: Included in its outside witness testimony before the House Interior and Related Agencies Subcommittee, the Gas Research Institute (GRI) proposed higher funding as shown below. EPRI is not known to have proposed a specific DOE funding level, but continues to support a substantial and sustained DOE funding level.

	DOE FY 1989 FUEL CELLS REQUEST	DOE FUNDING LEVELS PROPOSED BY GRI
Phosphoric Acid Fuel Cells	$ 0	$ 2,700,000
Molten Carbonate Fuel Cells	3,469,000	10,000,000
Advanced Concepts	2,168,000	10,000,000
TOTAL	$ 5,637,000	$22,700,000

FUEL CELLS
Question 6B

QUESTION: In answers for the record from the March 1 budget hearing the Department indicates that several fuel cell products could well be on the market within 5 to 10 years. When is it expected that Japanese or European manufacturers will offer for sale a commercially available fuel cell for either electric power or transportation uses?

ANSWER: Japan's Agency of Industrial Science and Technology stated in June 1987 that phosphoric acid fuel cells are "expected to become practical within ten years". Systems which have been demonstrated in user facilities include 1 MW and 200 kW power plants as well as fork lift trucks. The projected date for market entry for these systems has not been announced, but commercialization efforts could presumably be initiated in the near term.

Japan's molten carbonate fuel cell program has shown as a target the development of a 1 MW power plant by 1995. If that target is met and further scale up and development continues smoothly, commercial sales could occur as early as the late 1990s.

Solid oxide fuel cells are at an early development stage in Japan and are not expected to be available as early as molten carbonate systems.

European manufacturers are not as far along the development cycle as the U.S. or Japan. Commercialization schedules would be very speculative.

FUEL CELLS
Question 6C

QUESTION: What support is being provided by the Japanese or European governments to stimulate the commercial development of this technology?

ANSWER: The Japanese government has reportedly committed a total of 57 billion yen ($407 million) to their overall fuel cell effort over a fifteen year period (1980-1995). Phosphoric acid and molten carbonate fuel cells are being emphasized with molten carbonate allocated $200 million over the 1985-1995 period. The funding for FY 1988 is reported to be approximately in the $10 million to $20 million range for phosphoric acid, $20 million for molten carbonate, and an unknown, but probably much smaller amount for solid oxide fuel cell research.

From 1980 to 1985 the European funding of fuel cell R&D is reported as $1 million to $2 million per year. Funding has increased sharply and was informally reported in 1987 to be about $17 million.

COAL SLURRY LEGISLATION
Question 7

QUESTION: Recently the Committee reported coal slurry legislation (S.801). That legislation contained a provision modifying section 2(c) of the Mineral Leasing Act to permit railroads or their affiliates, with certain stringent limitations, to obtain Federal coal leases in their land grant areas. What is your opinion of the effect of that amendment?

ANSWER: The amendment on one hand has energy security benefits in that it frees up additional coal for the various end use sectors. However, it is not certain that the amendment includes adequate protection to cover the captive shippers. There are other aspects of the amendment that must be reviewed and analyzed with the Department of the Interior before the effects can be determined.

FUEL CELLS
Question 1

QUESTION: Mr. Wampler, I am disturbed by the President's budget request for funding of the fuel cell programs. Earlier questions to Secretary Herrington drew an unsatisfactory response. Mr. Wampler, is our nation the leader in the development of fuel cell technology? How much more money will the Japanese devote to fuel cell research versus the President's FY89 request?

ANSWER: The U.S. continues to maintain the lead in the development of fuel cell technology world-wide. Commercialization of 200 kW phosphoric acid power plants is proceeding and multi-MW powerplant demonstrations in Japan and Italy are planned with fuel cell hardware from a U.S. manufacturer.

DOE is continuing the development of phosphoric acid fuel cells through a fully funded four year, $8.6 million contract with International Fuel Cells Corporation for an advanced electric utility "Configuration B" stack technology. Basic technology contracts initiated in FY 1988 will also continue through FY 1989.

The U.S. is also continuing to advance molten carbonate and solid-oxide fuel cell technology.

The funding by the Japanese government for fuel cell development in FY 1988 is reported to be in the range of $30 to $40 million. Phosphoric acid technology development is reportedly receiving about $10 to $20 million of these funds. FY 1989 funding has not been reported but is expected to be in the same range.

FUEL CELLS
Question 2

QUESTION: Mr. Wampler, Secretary Herrington earlier stated that "Japan is at least several years behind the U.S. in the development of the phosphoric acid fuel cell (PAFC) power plant." However, I have just learned that Fuji Electric Company of Japan is presently marketing a 200KW PAFC in the United States. In your opinion, is this fact consistent with the Secretary's earlier statement? Do you feel that Japanese are serious competitors in the fuel cell market?

ANSWER: Reportedly, there have been discussions between Fuji representatives and several groups in the U.S. concerning the capabilities and experience of Fuji with the 200 kW power plants. However, these private sector activities have not involved any sector discussions and are not known to have involved any sales of these power plants. The cost and performance of this technology is reported not to be competitive with the 200 kW units being offered by a U.S. developer. Commitments for over 60 of the U.S. units have been reported by IFC and GRI.

This information appears to be consistent with the view that the U.S. is maintaining a technology lead in this area and the U.S. leads other nations by at least several years.

FUEL CELLS
Question 3

QUESTION: Mr. Wampler, will the President's FY89 budget proposal for the Molten Carbonate Fuel Cell (MCFC) program allow for another solicitation to be made to develop a full scale molten carbonate stack in 1989? Do you see any need for additional funds in FY90 to advance the contractors to the point of being able to successfully respond to a new PRDA?

ANSWER: There are presently three major development contractors in the molten carbonate area. The contracts are funded through FY 1989 with prior year appropriations and $3.3 million of the requested FY 1989 funds. Additional funds will be required in FY 1990 to complete these contracts. As requested by the Congress, DOE will report to the Appropriation Committee by April 1, 1989, on the feasibility of reissuing a competitive solicitation by August 1989, for the subsequent scaleup of this technology.

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United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, DC 20510-6150

May 3, 1988

The Honorable J. Allen Wampler
Assistant Secretary
Fossil Energy Programs
U. S. Department of Energy
Washington, D.C. 20510

Dear Mr. Wampler:

I want to thank you for testifying before the Subcommittee on Energy Research and Development on April 28, 1988 on the Department's FY89 budget request for fossil energy and clean coal programs. As a follow-up to the hearing, I am enclosing several questions to be answered and included in the printed hearing record. I would like to receive the answers to these questions as soon as possible, but not later than May 27, 1988.

In addition to sending your responses to myself and my colleagues, please provide a copy of your written responses to Mr. Al Astrin of the full committee staff in room SD-304. If you have any questions concerning this request please contact Cheryl Moss at 224-7569.

Sincerely,

Wendell Ford

Wendell H. Ford
Chairman, Subcommittee on
Energy Research and Development

Enclosures

WF/tc

SENATOR DALE BUMPERS
QUESTIONS FOR ASSISTANT SECRETARY ALLEN WAMPLER
HEARING ON FOSSIL ENERGY AND CLEAN COAL BUDGET
APRIL 28, 1988

1. MR. WAMPLER, last November, this Committee held an interesting set of oversight hearings on the "Greenhouse Effect and Global Climate Change". Are you aware that the greenhouse gases already in the atmosphere have committed the earth to a 2 - 5 degree Farenheit warming?(this would occur in 2 to 4 decades)

Are you aware that global emissions of carbon dioxide have risen to an all time high? And that the major source of CO2 is the burning of fossil fuels?

Why then, in your budget justification section entitled "Principal Issues in Fossil Energy between now and 2000", is there no mention of the greenhouse effect?

2. Has the fossil energy office ever done an analysis of what its research and development priorities ought to be in light of the greenhouse effect? Have you ever prepared a set of options for R & D investments for the future of your program in the context of the greenhouse effect?

3. I recognize that you may view your mission as promoting the use of fossil fuels, and that energy policy which takes the greenhouse effect into account might be more appropriately developed by the Secretary of Energy.
Is there any policy coordination at the Secretarial level on this issue?
Is the greenhouse effect integrated into DOE's planning at this level?
Have you ever discussed the greenhouse effect at a management meeting at the Department?

4. I understand that the Asst. Secretary for Environment has a small amount of funding available to study the greenhouse effect. Do you receive any policy input from that office?

5. DOE'S Office of Energy Research has a division of Carbon Dioxide Research. In fact DOE is the lead agency for CO 2 research. Does your office receive data or policy recommendations from that research effort? Do you meet with the researchers working on carbon dioxide issues?

6. Carbon dioxide (CO 2) is a by-product of coal. Nitrous Oxide (N 2 O) is a by-product of coal. Both are greenhouse gases. CO and NOx are indirect greenhouse gases produced by coal.

Does your program analyze the impact of the various fossil technologies on these greenhouse gases?
Are you prepared to examine the impact of the various technologies under your jurisdiction on the greenhouse effect?

7. I understand that coal produces about twice the CO2 per BTU as does natural gas. Yet you intend to spend $101 million on coal research and about $1 million on gas? Why?

8. You also have a massive effort underway to demonstrate Clean Coal Technologies - with over $500 million in advance appropriations for FY 89.

What in your mind is the definition of clean coal?

I understand that this effort is directed towards the acid rain problem. Will this huge program have any impact on reducing emissions of greenhouse gases? Or will it actually increase the emissions of greenhouse gases by stimulating coal use rather than conservation ?

QUESTIONS FROM MINORITY MEMBERS
DOE FY89 FOSSIL BUDGET HEARING
APRIL 28, 1988

QUESTIONS FOR DOE ASSISTANT SECRETARY J. ALLEN WAMPLER

QUESTIONS FROM SENATOR JAMES A. McCLURE.

1. The opening line of the Assistant Secretary's prepared testimony supports a "sound coal research and development program" yet once again the Administration proposes major reductions in these vary programs compared to fiscal year 1988.

   a. For each program area, what will be the effect of these reductions on long-term, high-risk research and development capabilities?

   b. For each program area, what will be the attendant reductions in Federal and contractor personnel?

2. The opening line of the Assistant Secretary's prepared testimony also supports a "new emphasis on the enhanced recovery of oil; however, level funding is proposed between fiscal years 1988 and 1989. What is the basis for characterizing this proposal as "new emphasis"?

3. The opening line of the Assistant Secretary's prepared testimony also emphasizes initiation of a two-phase cooperative R&D venture program in fossil energy.

   a. How would this program be structured?

   b. What is the specific statutory authority for this program? Will legislation be sought from the Congress?

4. How does the Administration's proposed FY89 fossil energy budget compare to the program that the Gas Research Institute has indicated that it is prepared to support?

5. We are all aware of the Cool-Water Coal Gasification Program that received a loan from the U.S. Synthetic Fuels Corporation.

   a. What is the status of the Cool-Water Coal Gasification Program? For example, when will the SFC support terminate? What will happen at that time?

   b. What support does the Cool-Water project receive either directly or indirectly from the Department of Energy?

   c. Does the Department consider the continued operation of the

Cool-Water facility as important to achievement of the objectives of the clean coal technology program?

d. What are the plans of the present sponsors for continued operation? If they are not prepared to continue operation of the facility, why not?

e. As the DOE clean coal program is presently constituted would the Cool-Water project be eligible to seek support from DOE?

6. a. How does your FY89 budget request for fuel cell research compare to the level of funding that the Gas Research Institute and EPRI has indicated that it is prepared to support?

b. In answers for the record from the March 1 budget hearing the Department indicates that several fuel cell products could well be on the market within 5 to 10 years. When is it expected that Japanese or European manufacturers will offer for sale a commercially available fuel cell for either electric power or transportation uses?

c. What support is being provided by the Japanese or European governments to stimulate the commercial development of this technology?

7. Recently the Committee reported coal slurry legislation (S. 801). That legislation contained a provision modifying section 2(c) of the Mineral Leasing Act to permit railroads or their affiliates, with certain stringent limitations, to obtain Federal coal leases in their land grant areas. What is your opinion of the effect of that amendment?

QUESTIONS FOR ASSISTANT SECRETARY J. ALLEN WAMPLER
U.S. DEPARTMENT OF ENERGY
SENATOR LOWELL WEICKER, JR.
APRIL 28, 1988

1) Mr. Wampler, I am disturbed by the President's budget request for funding of the fuel cell programs. Earlier questions to Secretary Herrington drew an unsatisfactory response. Mr. Wampler, is our nation the leader in the development of fuel cell technology? How much more money will the Japanese devote to fuel cell research versus the President's FY89 request?

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3) Mr. Wampler, will the President's FY89 budget proposal for the Molten Carbonate Fuel Cell (MCFC) program allow for another solicitation to be made to develop a full scale molten carbonate stack in 1989? Do you see any need for additional funds in FY90 to advance the contractors to the point of being able to successfully respond to a new PRDA?